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MASTERS OF APPLIED EPIDEMIOLOGY

NATIONAL CENTRE FOR EPIDEMIOLOGY AND POPULATION HEALTH

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CANBERRA

By

David Francis Cheah

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Acknowledgments

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Dr Aileen Plant	NCEPH.
Dr Mathew Gaughwin	formerly of NCEPH.
Prof. R Douglas	Director, NCEPH.

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Section 5 REVIEW OF A COMMUNICABLE DISEASE SURVEILLANCE SYSTEM

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* ACT Notifiable Diseases Database.
* The Australian Tuberculosis Reporting System.

Section 6 SUMMARY OF PRACTICAL EPIDEMIOLOGICAL EXPERIENCE GAINED

Section 7 ONGOING AND CURRENT PROJECTS

Attachments :

* Evaluation of outcomes of screening and management of M Tb for foreign born Australians.
* Culture positive tuberculosis in Australia, 1989 - 1991.
* A Survey of M Bovis in Australia, 1982 - 1991.

Section 8 MISCELLANEOUS ACTIVITIES/REPORTS

Attachments : ,

* Controlling Tuberculosis in Australia. A report by the TB Panel, NHMRC.
* WHO, Tuberculosis Control Programme. NTCP Database.
* Proforma for Mutual Assistance Programme : Australia.
* Questionnaire on Anti Tuberculosis Drug Supply.
* Tuberculosis Data - 1990.

INTRODUCTION

I spent my placement for the Masters of Applied Epidemiology at the Communicable Diseases Section, within the Commonwealth Department of Health, Housing and Community Services, located in Woden, ACT. The functions of the Section are to conduct national surveillance of communicable diseases, publish these epidemiological data in the *Communicable Diseases Intelligence*, on a fortnightly basis and integrate public health policy on a national level. The Section also coordinates the functions of the Communicable Diseases Network (Australia and New Zealand) and supports various public health committees of the National Health and Medical Research Council. During my two year placement, I have contributed to the surveillance of tuberculosis by designing a national surveillance system for tuberculosis. As well, I have enhanced the surveillance of drug resistance patterns for the anti tuberculous drugs used in Australia, by networking with the TB Reference Laboratories. During my placement, I have also been involved with the Communicable and Environmental Diseases Control Section of the ACT Board of Health. My role there is in supporting the Manager of the unit in areas of outbreak investigation and public health response in an outbreak. My experiences in outbreak investigation have been gained entirely in the ACT. These experiences are described in this submission. I would like to declare that all my contributions are original and that all collaboration with other workers is indicated where appropriate. This bound volume consist of nine sections, each of which is accompanied by attachments.

SECTION 1

SECTION 1 FIELD INVESTIGATIONS

During the course of the MAE programme, I was involved in several field investigations, including the following :

1 **Measles Outbreak in Canberra, October to December 1991**

In late September, 1991, an increase in measles notification to the ACT Board of Health, led us to suspect that a measles outbreak was apparent in the ACT. Based on the source of these notifications, I began to investigate this outbreak. This investigation subsequently led to an article in CDI, and a further investigations into the vaccine effectiveness of measles in a high school (see Section 2).

2 **Gastroenteritis outbreak in Canberra, January 1992**

On the evening of 18th January, 1992, I was informed that four guests who had attended a wedding party that afternoon, visited the Calvary Hospital, suffering from gastroenteritis. I suspected an outbreak and began an investigation which later resulted in a report to the CDI (see Section 2).

3 **Measles vaccine efficacy study in Orana Primary School, Canberra, March to April 1992**

Concerned parents reported an outbreak of measles in the Orana Primary School, to the ACT Board of Health. This primary school is an alternative school, belonging to the Rudolf Steiner school system. A significant

proportion of the children here are not immunised because of personal beliefs of the parents. Since the outbreak was over at the time of the reports, an opportunity existed for a vaccine effectiveness study. This study targeted the effectiveness of measles vaccine in the 10 - 14 year age group. This study was conducted with certain restrictions placed on the study design. A report was subsequently published in the CDI (see Section 2).

4 **Measles vaccine efficacy study in Lyneham High School, Canberra, February to June 1992**

A cohort study was performed in Lyneham High School, Canberra, in the first semester of 1992, to study the effectiveness of measles vaccine. This study targeted the 15 - 19 agegroup in relation to measles vaccine effectiveness. This school had the highest attack rate for measles during the 1991 outbreak. A paper describing our findings was subsequently sent to the *Journal of Paediatrics and Child Health* for consideration for publishing (see Section 4).

5 **Rubella Outbreak in Canberra, September 1992**

In early September, 1992, Lyneham High School reported an unusually high amount of absenteeism in Grades 9 and 10 in their school. It was initially suspected that another measles outbreak was occurring. We investigated the first 19 cases of absenteeism and discovered that the students had suffered from an illness, similar to either rubella or measles. Serology taken confirmed the presence of rubella antibodies. This confirmed the beginning

of a larger outbreak of rubella in the ACT.

6 **Rubella vaccine efficacy in Lake Ginninderra College, Canberra, November to December 1992**

A study of all secondary children in Lake Ginninderra College was undertaken to look at the effectiveness of rubella vaccination in secondary children. Lake Ginninderra College also reported a high proportion of absenteeism due to rubella. We used a similar methodology to that used in Lyneham High School. A report of this study was sent to the MJA as a letter to the Editor, for consideration for publication (see Section 4).

SECTION 2

SECTION 2 REPORTS PUBLISHED IN THE *Communicable Diseases Intelligence Bulletin*

The various field investigations that I performed resulted in several reports to the *Communicable Diseases Intelligence Bulletin.* Other reports came from analyses of previously available Tuberculosis Statistics, new data from the States and Territories Health Departments, and data derived from the new system of TB surveillance (see Section 5). The articles published in *CDI*, and the dates of publication are detailed below and are attached to this Section.

1 Tuberculosis Briefs 1 - Notification rates. Published on 21st September 1991.

2 Tuberculosis Briefs 2 - An Analysis by Country of Birth. Published on 2nd December 1991.

3 Staphylococcus Gastroenteritis Outbreak in Canberra following a church lunch. Published on 24th February 1992.

4 Measles Outbreak in Canberra, Oct to Dec 1991. Published on 23rd March 1992.

5 TB Notification Rates in Australia : Final Data, 1986 - 1990. Published on 1st June 1992.

6 An estimate of Measles Vaccine Efficacy in a Canberra Primary School. Published on 13th July 1992.

7 Tuberculosis Notification Rates, Australia, 1991. Published on 21st September 1992.

TUBERCULOSIS BRIEFS 1 - NOTIFICATION RATES

(Dr David Cheah, NCEPH Epidemiology Registrar, Communicable Diseases Section, Department of Health, Housing and Community Services, Canberra, ACT)

This is the first of a series of reports on tuberculosis (TB) in Australia, based on data collected recently from all States and Territories.

Introduction

Data on the epidemiological aspects of tuberculosis have not been published by the Commonwealth Department of Health, Housing and Community Services since 1985. Medical authorities involved with the treatment and supervision of tuberculosis patients at the state level have requested the analysis and publication of such data. Attempts in the recent past to analyse available data had limited success because of problems with the reliability of the data, and the inconsistent nature of the reporting.

The rate of notification of tuberculosis in Australia fell from 46.8 per 100,000 in 1948 to 7.0 per 100,000 in 1985, the year that national data on tuberculosis was last published. Those data consisted of several separate categories, including new cases of tuberculosis, atypical tuberculosis and relapses (reactivations). Notification rates reported in the past consisted of "all forms" of tuberculosis, including new cases plus atypical cases, but excluding relapses. This form of reporting has limited usefulness, especially if the data are to be assessed against the background of the current HIV epidemic. Separation of new cases and atypical tuberculosis is

imperative if the impact of HIV/AIDS on the tuberculosis rates is to be estimated. This report on the notification rates, post 1985, differentiates between the different categories of notifiable cases.

We used a series of forms modified from the previously used TB reporting forms to elicit information from the States and Territories, to obtain data consistent with the new Surveillance system currently used in every State and Territory.

Definitions used.

In this analysis, the case definitions used are :

1 New Cases (Tuberculosis)

(a) A case of tuberculosis which has been confirmed by the identification of Mycobacterium tuberculosis by culture or by microscopy. Infectious agents are usually Mycobacterium tuberculosis and M. africanum primarily from humans and M. bovis (not including BCG - bovis) primarily form cattle.

(b) A case of Tb which has been diagnosed by a clinician to be active clinically and which has been accepted, as such, by the State or Territory Director of TB.

2 Relapses (Reactivation)

A case of active tuberculosis diagnosed by a clinician again (bacteriologically, radiologically or clinically) following previous full treatment (as deemed appropriate by the Director of TB), and considered to be inactive or quiescent.

3 Atypical Mycobacterial Infection

An active case is one where one or more of the following features are present :

- there are clinical features consistent with one or more of the syndromes associated with atypical mycobacteria.
- there is a compatible disease process which is clinically, radiologically, and/or pathologically not due to other causes.
- there is consistent repeated recovery of the same organism from the same site in moderate to abundant amounts.
- there is recovery of atypical mycobacterium from sites which are normally sterile.

4 Population

The number of persons living in an area at mid year (supplied by the Australian Bureau of Statistics).

5 Tuberculosis Deaths

Deaths from tuberculosis (all forms ie including atypical and relapses) reported by a clinician during the year, including deaths due to, and incidental to, the disease.

Results

The rate of notification of all forms of TB excluding relapses has fallen from a peak of 56.5 per 100,000 in 1953 and has been below 10 per 100,000 since 1980

(Figure 1). Since 1987 there has been a slight upward trend from 6.3 to 7.5 per 100,000. For 1989 and 1990 NSW data are unavailable and denominators have been adjusted accordingly. The rate of notified new cases of TB has been fairly constant at between 5.71 and 5.34 per 100,000 over the last five years but there has been an upward trend in "atypical" disease over the same period (Figure 2). The infected population (comprising new cases and relapses) has remained fairly constant between 5.59 and 5.89 per 100,000 since 1986, and the crude death rate has increased from 0.32 to 0.53 per 100,000 over the same period (Figure 3). Numbers of new cases, "atypical" cases, new and relapsing cases and deaths since 1986 are shown in the Table.

New cases, atypicals, new cases+relapses and deaths, 1986 - 1990.

	1986	1987	1988	1989	1990
New cases	899	870	922	591	633
"Atypicals	212	163	218	228	209
New+Relapses	944	909	951	626	663
Deaths	51	68	60	35	35

* 1989 and 1990 data excludes NSW

Discussion

The incidence of new tuberculosis cases in Australia has not increased in recent years. This is in contrast with the United States, which has an increasing rate since 1986, attributed to HIV disease (1). In Australia, closer analysis of the data may be necessary to detect any relationship between the HIV epidemic and TB notifications. The rate of reported atypical disease has increased significantly since 1985. Future reports on tuberculosis from the CDI will include analysis of atypical disease, patterns of disease, age groups, and country of birth of reported cases.

References

1 Barnes PF, Bloch AB, Davidson PT, Snider DE. Tuberculosis in patients with Human Immunodefiency Virus Infection. The New England Journal of Medicine. 1991;324:1644-1650.

2 Commonwealth Department of Health. Tuberculosis Statistics, 1980-1985.

FIGURE 1 - Tuberculosis rates in Australia, 1948 - 90.

Notification for all forms*

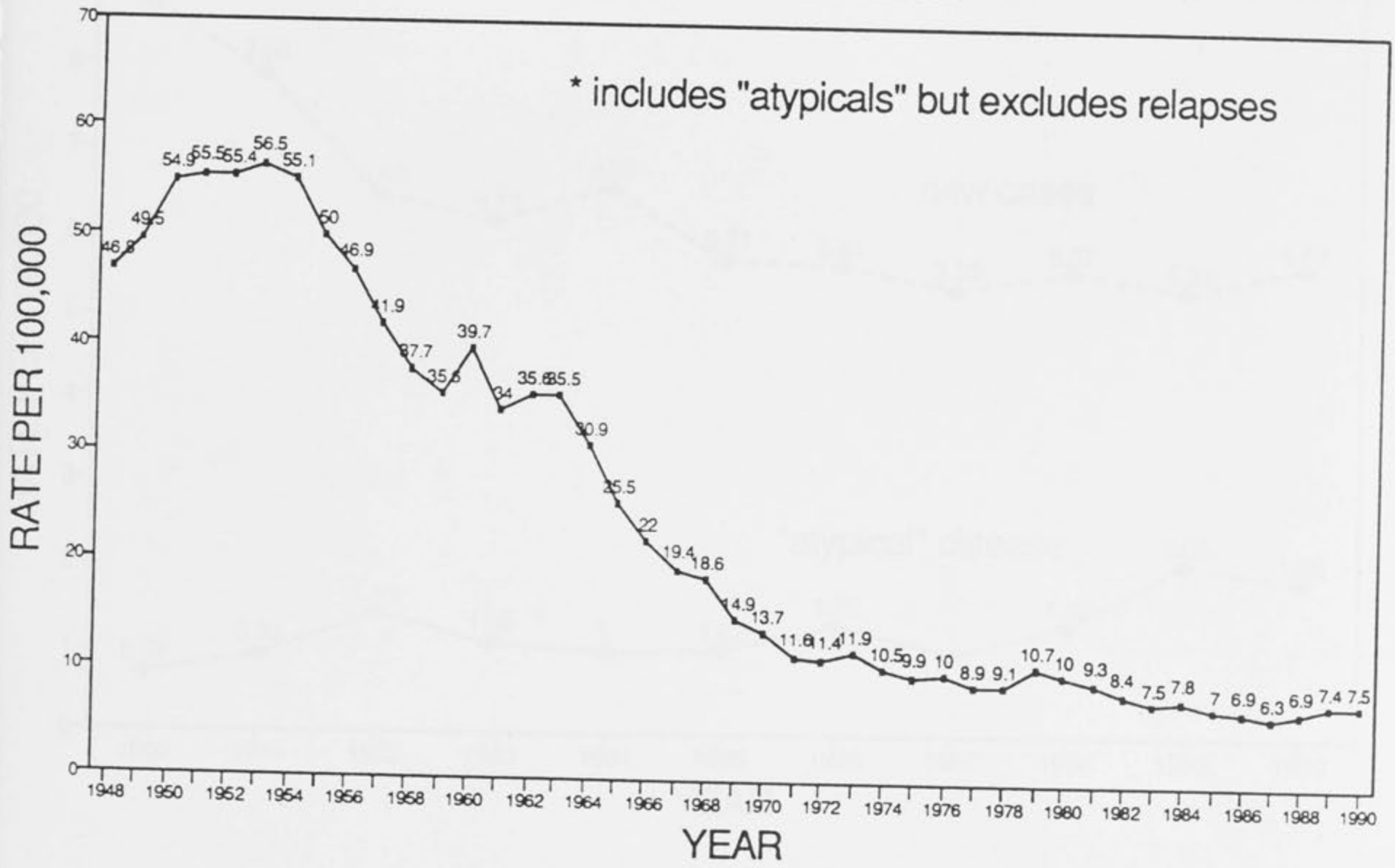


FIGURE 2 - Tuberculosis rates in Australia, 1980 - 1990

New cases and "atypicals"

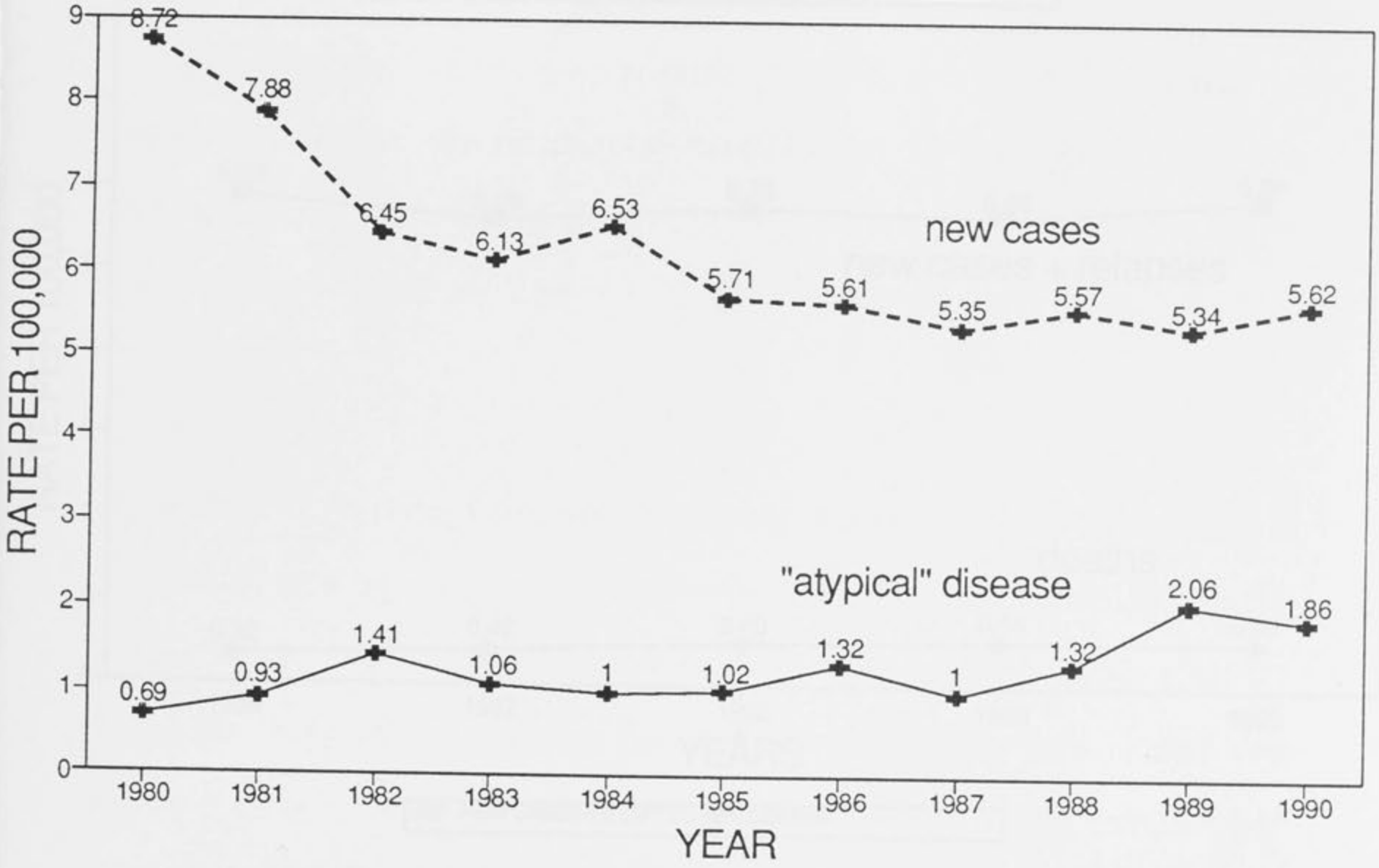
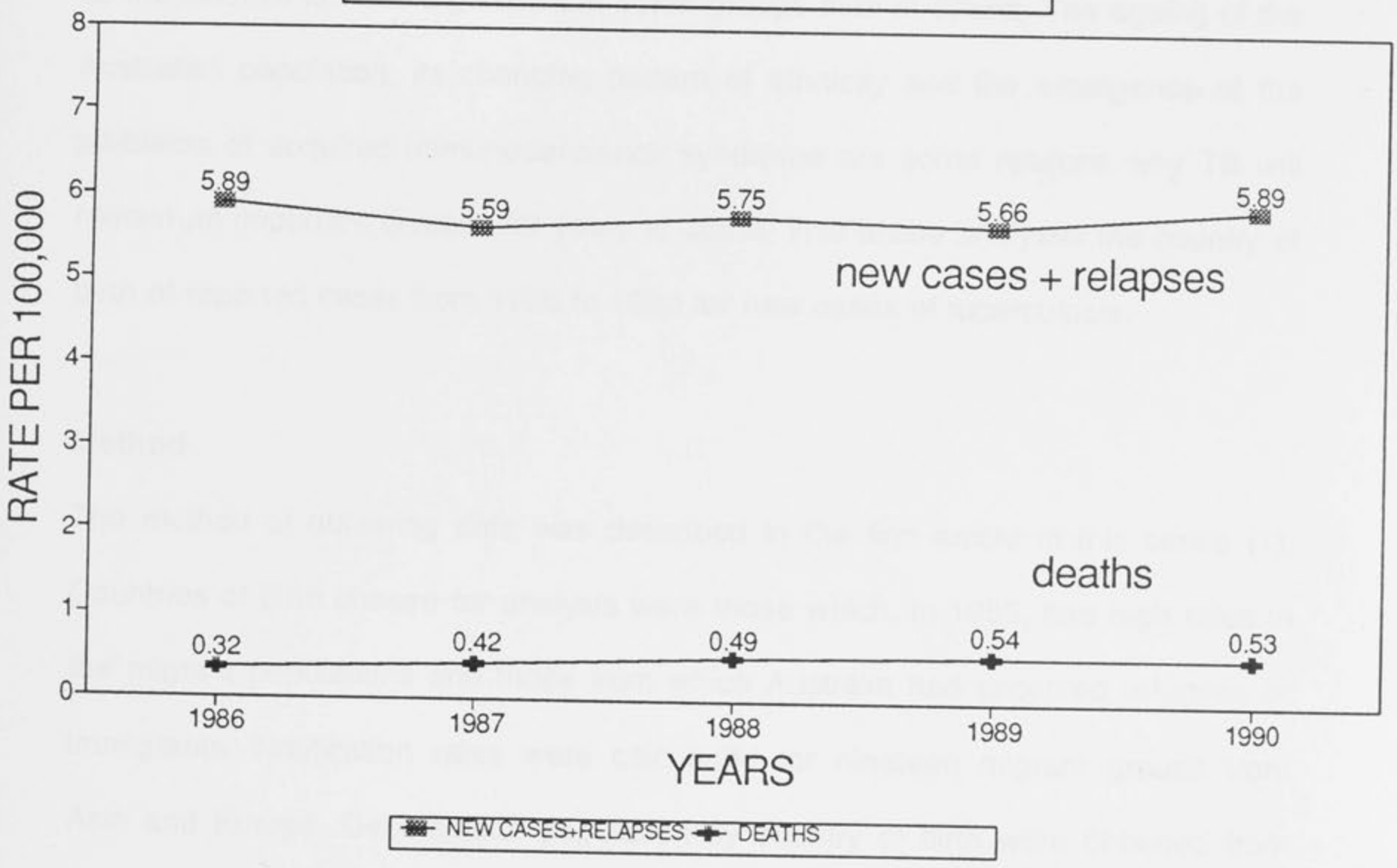


FIGURE 3 - Tuberculosis rates in Australia, 1986 - 90.

New cases & relapses, and deaths



TUBERCULOSIS BRIEFS 2 - AN ANALYSIS BY COUNTRY OF BIRTH

Introduction

Since 1985, the rate of notification of new cases of tuberculosis (TB) in Australia has been almost static, ranging between 5.34 and 5.71 per 100,000 population per year. The notification rates are not, however, equal in all parts of the community, as the disease is more significant in some groups than in others. The ageing of the Australian population, its changing pattern of ethnicity and the emergence of the problems of acquired immunodeficiency syndrome are some reasons why TB will remain an important disease for years to come. This article analyses the country of birth of reported cases from 1986 to 1990 for new cases of tuberculosis.

Method

The method of obtaining data was described in the first article in this series (1). Countries of birth chosen for analysis were those which, in 1985, had high rates in the migrant populations and those from which Australia had accepted refugees or immigrants. Notification rates were calculated for nineteen migrant groups from Asia and Europe. Denominator population by country of birth were obtained from the Australian Bureau of Statistics.

Results

A comparison of the rate of notification of tuberculosis in Australia between 1986 and 1990 by birthplace ("Australian" born or "Foreign" born) shows that the rate in Australian born persons declined from 2.82 to 2.15 per 100,000 per year between

1986 and 1990 (Figure 1). The rate for foreign born cases was much higher and fluctuated between 15.69 (1987) and 17.99 (1990) per 100,000. For Australia as a whole, the proportion of cases in Australian born persons declined, from 39.4% in 1986 to 34.5% in 1990. The proportion in foreign born persons increased from 60.3% in 1986 to 70.4% in 1990 (Table).

Table - Place of birth for cases of tuberculosis in Australia, 1986 - 1990.

Year	Australian born		Foreign born		Unknown	
	Cases	%Total	Cases	%Total	Cases	%Total
1986	356	39.4	545	60.3	3	0.3
1987	350	38.8	547	60.6	5	0.6
1988	329	34.9	613	65.1	0	0
1989	312	34.4	591	65.1	5	0.5
1990	284	28.8	693	70.4	8	0.8

In NSW, Victoria, South Australia and Western Australia, the majority of cases has been in foreign born persons during this period and the tendency was towards increased numbers of reports in foreign born persons (Figure 2). In the Northern Territory, the percentage of Australian born cases increased from 61.5% in 1986 to 83.3% in 1990. This can be attributed to the increased in new cases in Aboriginal Australians during those years (unpublished data, NT Department of Health and Community Services). In the ACT, in 1986 100% of cases were foreign born, declining

to 50% in 1990. In Queensland, there was a trend toward increased notifications amongst foreign born persons. The small number of cases in Tasmania and the incompleteness of their place of birth data prevents detailed analysis for that State. The 1986 - 88 average rates of notifications determined for population groups according to country of birth showed that the rate in Australian born persons was lower than the rates for all of the other groups, except those born in Lebanon (Figure 3). The highest rates were in persons born in Vietnam, Philippines, Cambodia, China and Laos.

Discussion

Caution should be exercised in the interpretation of these data. First, although the rates of notification from some migrant groups are large, the total populations of these groups are often small. Second, the high rates in some migrant groups do not seem to have posed an increased risk for the general community, as the rate for Australian born cases declined over the five year period. This suggests that infection of Australian born persons by overseas born cases does not occur to a significant extent.

Unfortunately, the data available for analysis in this report do not include the time elapsed between arrival in Australia and the notification of the disease. However, in NSW, in 1986, only 11% of reported cases of tuberculosis in persons born overseas had been resident in Australia for less than one year (2). In the Northern Territory in 1990, the mean length of time for notification of new cases for persons born overseas was 7.5 years (unpublished data, NT Department of Health and Community Services). The national TB surveillance system has recently been enhanced to enable analysis of time elapsed from arrival to notification in future years.

References

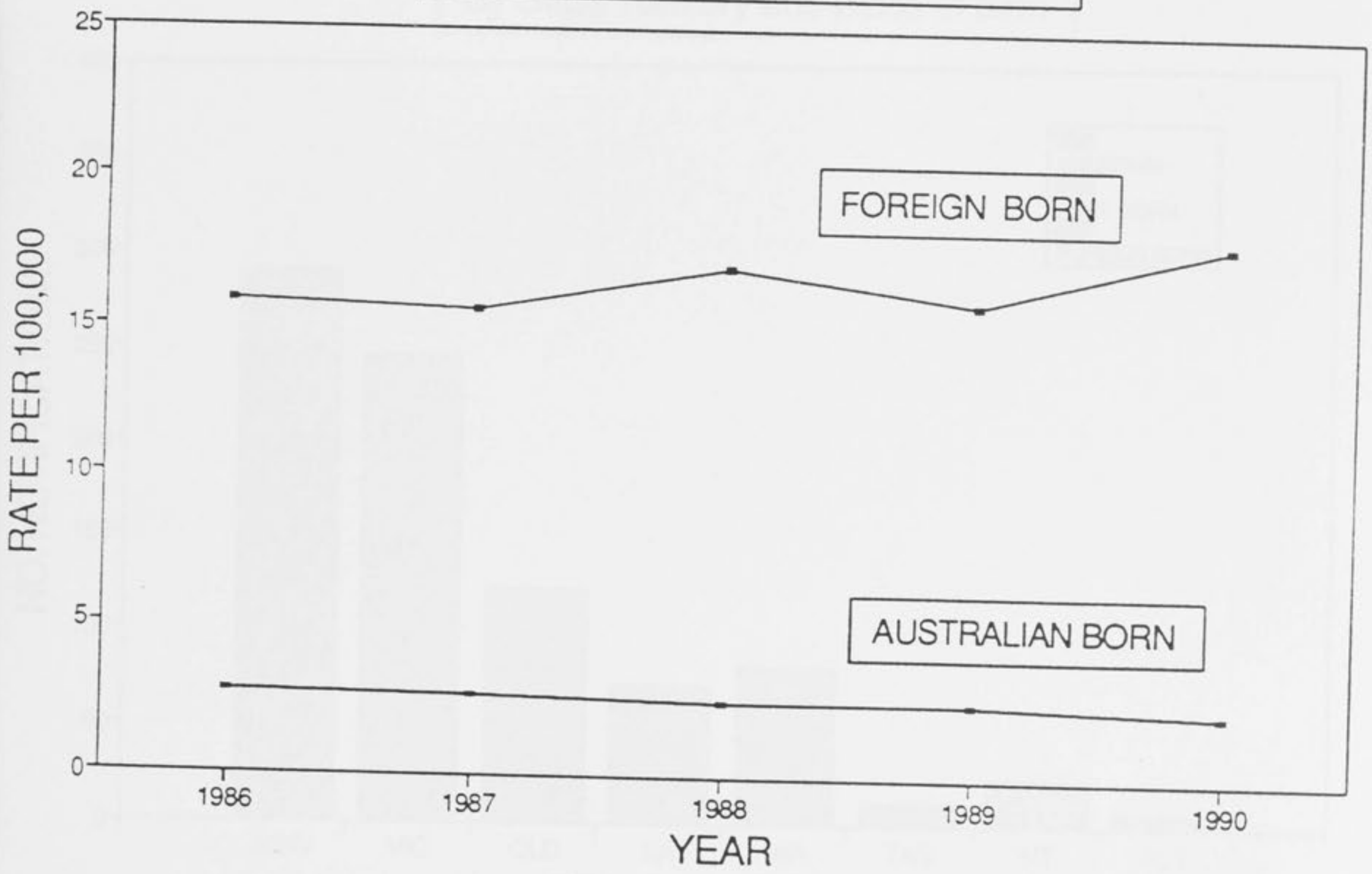
1 Tuberculosis Briefs 1 - Notification Rates. *Comm Dis Intell* 1991;15267-269.

2 Plant AJ, Rushworth RL, Wang Q, Thomas M. Tuberculosis in NSW. *Med J Aust* 1991;154:86-89.

3 Orr PH, Manfreda J, Hersfield ES. Tuberculosis surveillance in immigrants to Mannitoba. *Canadian Medical Association Journal* 1990;142:453-458.

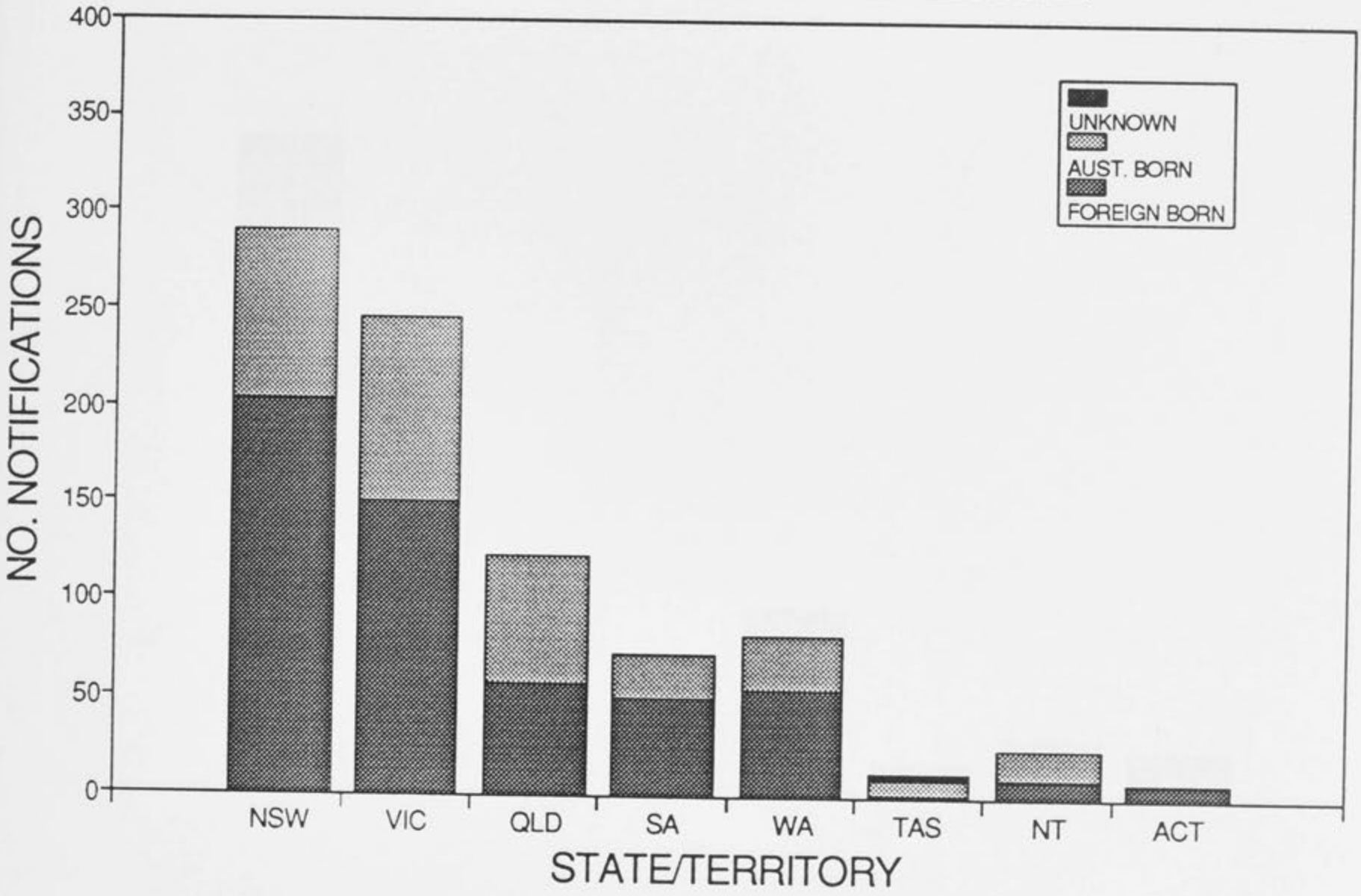
Figure 1 - Tuberculosis rates in Australia, 1986-1990

"Australian born" and "Foreign born"



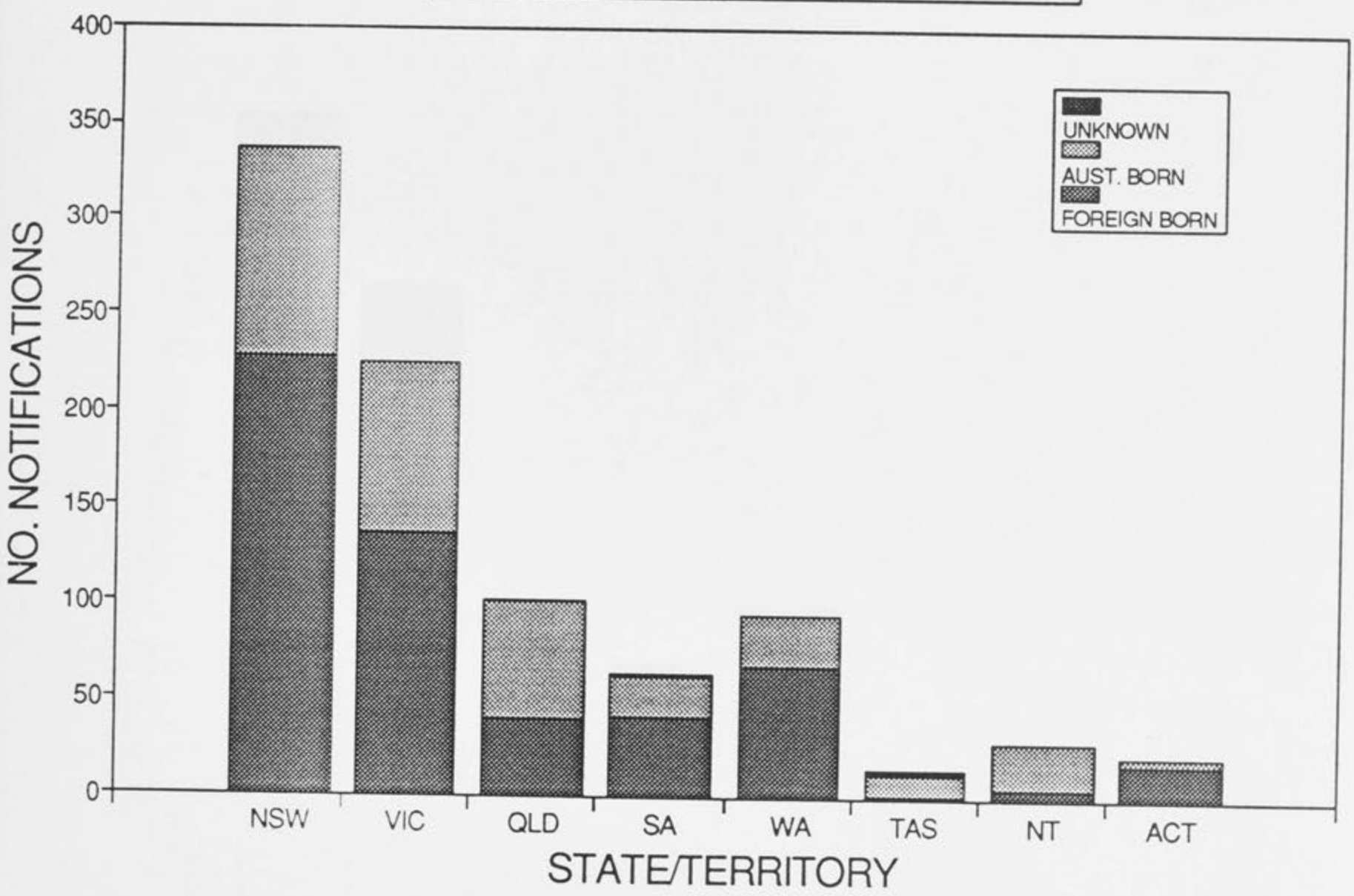
TUBERCULOSIS NOTIFICATION, 1986

By State/Territory and place of birth



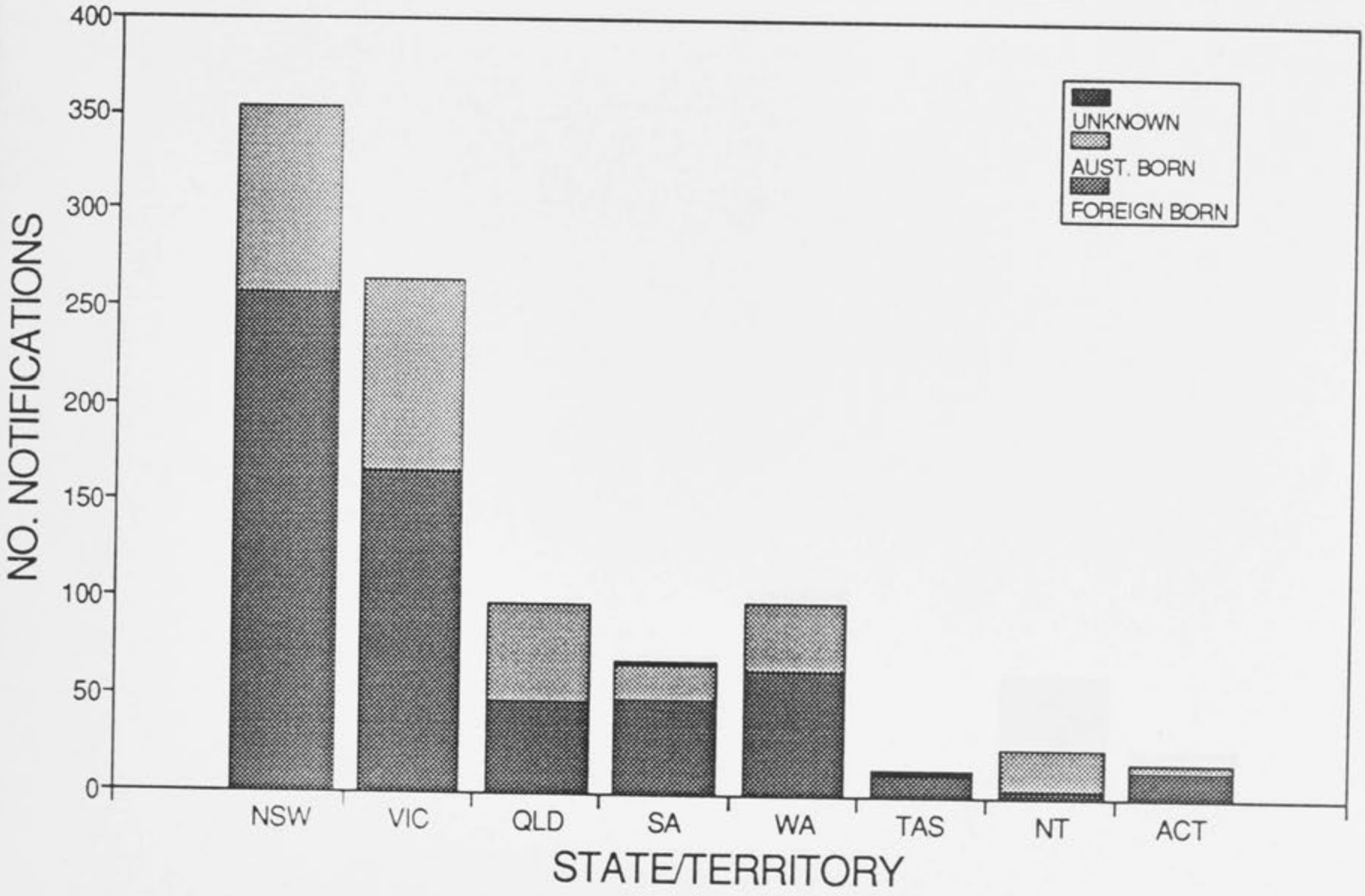
TUBERCULOSIS NOTIFICATION, 1987

By State/Territory and place of birth



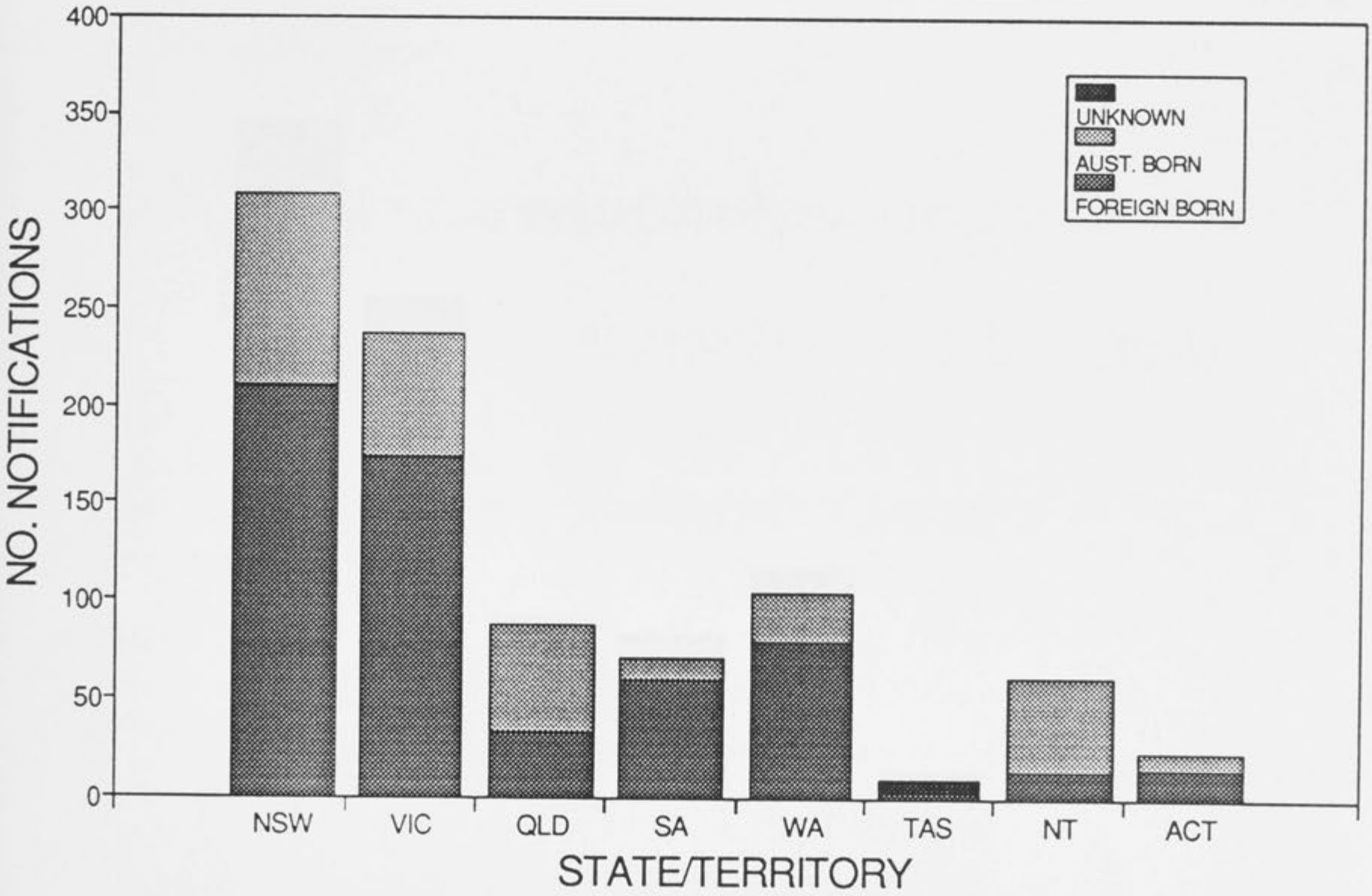
TUBERCULOSIS NOTIFICATION, 1988

By State/Territory and place of birth



TUBERCULOSIS NOTIFICATION, 1989

By State/Territory and place of birth



TUBERCULOSIS NOTIFICATION, 1990

By State/Territory and place of birth

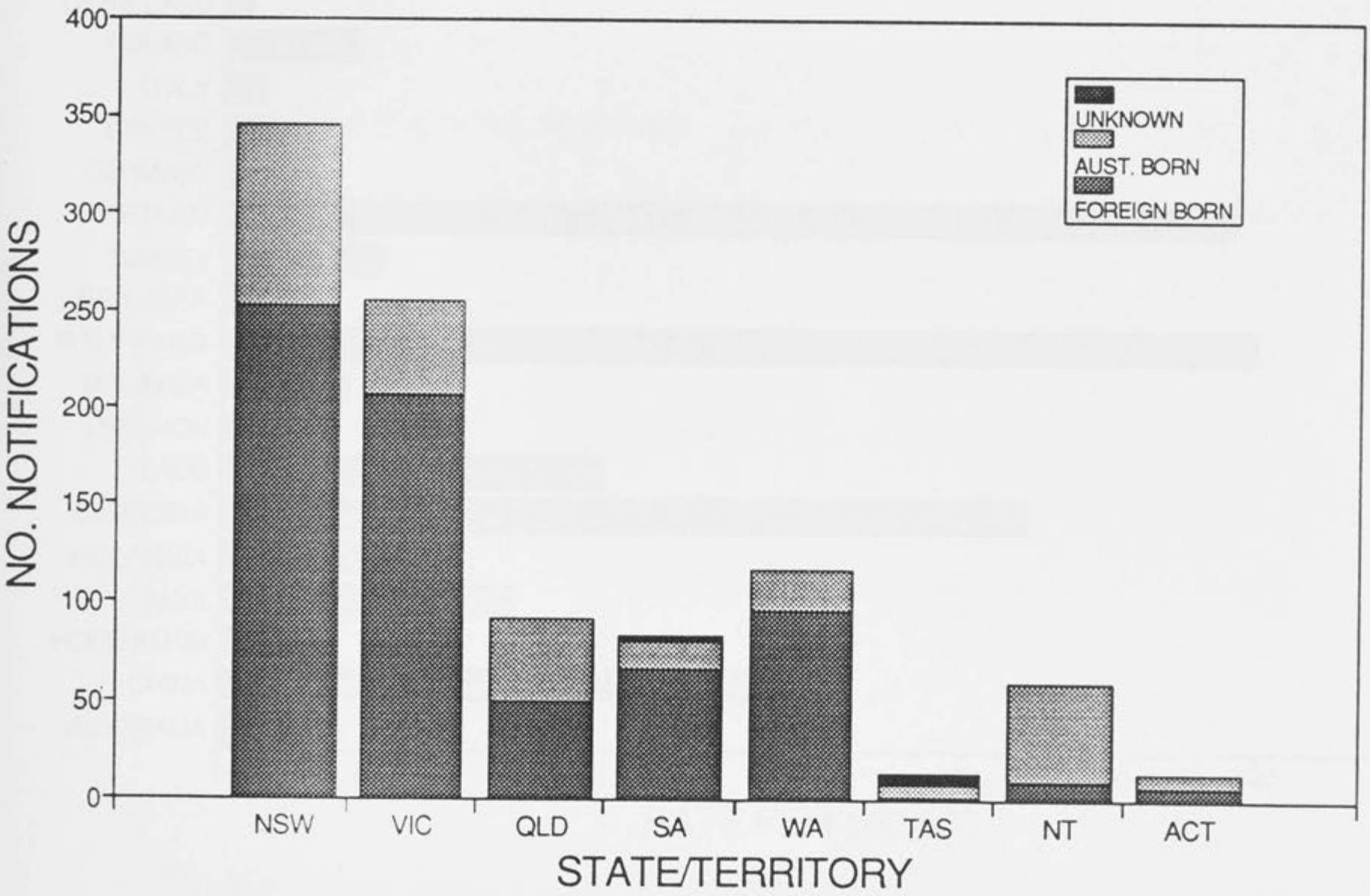
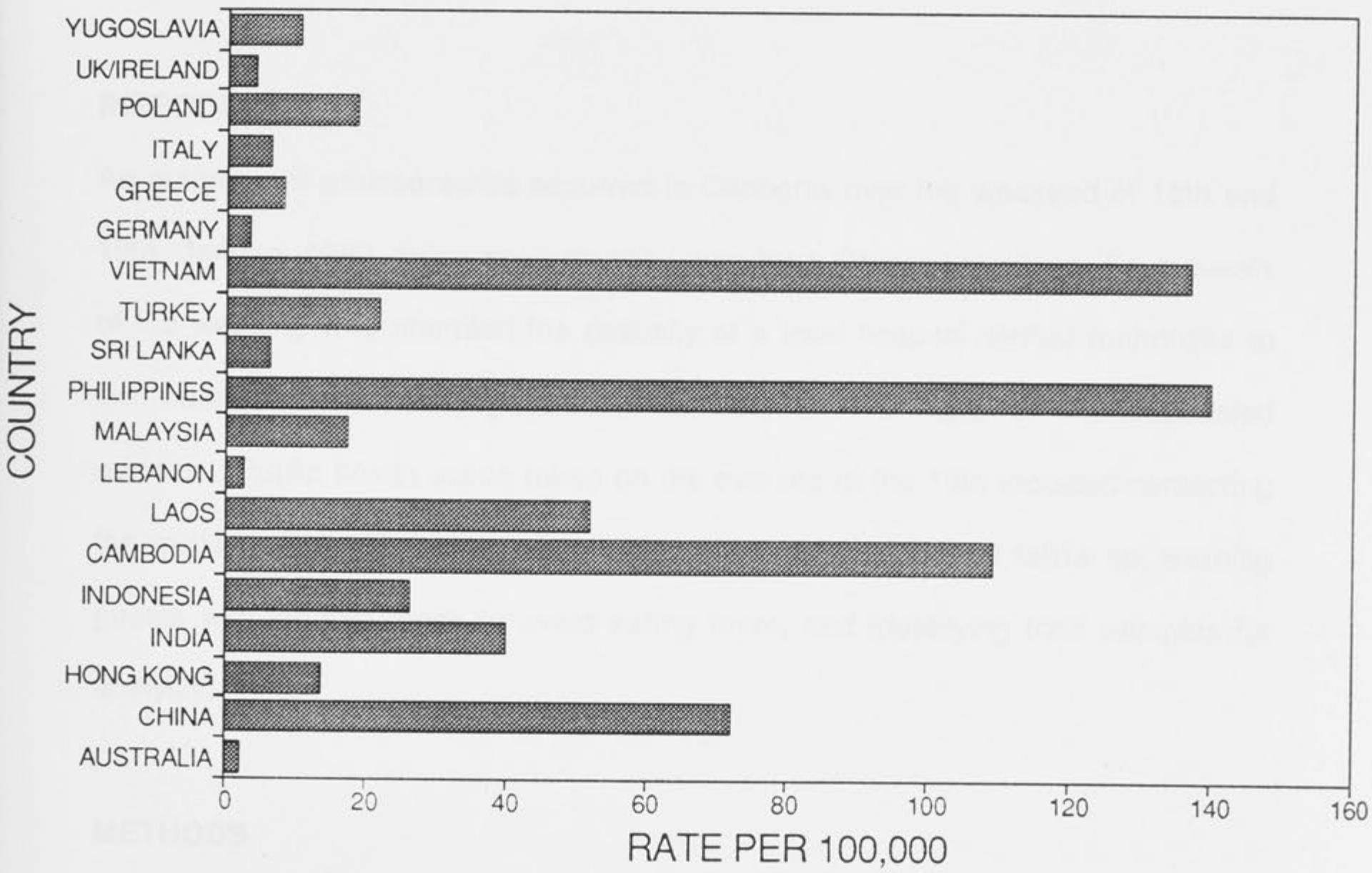


Figure 3 - Rate of tuberculosis in Australia by country of birth, 1986-88 avarage



STAPHYLOCOCCUS GASTROENTERITIS OUTBREAK IN CANBERRA FOLLOWING A CHURCH LUNCH.

(David Cheah, Epidemiology Registrar, Communicable Diseases Section, Commonwealth Department of Health, Housing and Community Services, Peter Kong and Simon Ng, Environmental Health Officers, Public and Environmental Health Service, ACT Board of Health.)

INTRODUCTION

An outbreak of gastroenteritis occurred in Canberra over the weekend of 18th and 19th, January 1992, following a church lunch for a Chinese wedding. Four guests of the wedding who attended the casualty of a local hospital alerted authorities to the outbreak. The investigation commenced on the night of the suspected outbreak. Public health action taken on the evening of the 18th included contacting the wedding organisers to obtain a list of guests for subsequent follow up, warning guests with leftover foods to avoid eating them, and identifying food samples for analysis.

METHODS

We constructed a questionnaire to record data, including demographic characteristics of the guests, food histories, and basic clinical details. We defined a case of gastroenteritis as anyone who had eaten food from the wedding party who developed vomiting, diarrhoea or abdominal cramps within 6 hours of eating. We entered the collected data into Epi Info for analysis.

RESULTS

All of the 52 guests who attended the wedding were contacted, with 50 being contacted within forty eight hours following the outbreak. Investigations commenced within six hours of the wedding dinner. Predominant symptoms in the 16 guests who developed gastroenteritis were diarrhoea (87.5 %), vomiting (87.5%), abdominal cramps (43.8%) and nausea (18.7%). There were no secondary cases.

Time

Figure 1 presents the outbreak curve. The mean incubation period was 3.4 hours following the consumption of food provided at the party. The mean duration of symptoms was 14.9 hours. Most of the cases were well by the next day. All the cases returned to normal activities by Monday 20/01/92. We excluded three guests from analysis. One girl had gastroenteritis concurrently, one was taking Erythromycin for tonsillitis, and one was a vegetarian who did not eat food at the function.

Place

The wedding reception took place in a church in the northern suburbs of Canberra. Volunteers from members of the church cooked various dishes in their home kitchens. At least two cooks were involved in the food preparation. Food items presented for consumption included spring rolls, curry pastries, gelatinous rice, noodles, sweets, drumsticks, sushi, ham and cheese sandwiches, and egg sandwiches. The noodles were boiled on the evening before the outbreak and

were cooked on the morning of the party. They were left in the open overnight as there was insufficient room in the refrigerator for storage. The egg sandwiches were prepared on the morning of the party. Both noodles and egg sandwiches were carried to the church in cars, unrefrigerated, and allowed to stand at room temperature for several hours in the church before consumption.

Person

16 guests (32.7%) were affected with symptoms of gastroenteritis within a few hours of the party. Both males and females were affected equally (M:F ratio = 1:1). The guests were mainly members of the Chinese community of middle to upper class background. 50% of those who were affected needed medical attention, either in the casualty of the local hospital or by general practitioner attendance.

Analysis of the food histories

We analysed food item specific attack rates using Epi Info. Table 1 presents the food specific attack rates. The three foods with the highest attack rates were egg sandwiches, sushi and noodles. Those who ate egg sandwiches and were ill, also ate noodles. The noodle and sushi dishes were prepared by the same cook whilst the egg sandwiches were prepared by two others who used the same kitchen.

Table 1 - Food Specific Attack Rates among 49 guests at a Wedding Party, Canberra, 1992.

Food Items	No. who ate	No. ill	Attack Rate
Spring roll	40	10	25%
Curry pastries	43	13	30.2 %
Gelatinous rice	36	12	33.3 %
Noodles	42	16	38.1 %
Sweets	32	10	31.2 %
Drumstick	37	12	32.4 %
Sushi	37	15	40.5 %
Ham/Cheese Sandwich	14	4	26.6%
Egg sandwich	17	7	41.2 %
Total	49	16	32.7 %

Leftover foods available for testing in the ACT Government Analytical Laboratory included noodles, sushi, ham and cheese sandwiches, cakes and drumsticks. These had been kept by one of the cases in a refrigerator following the wedding. No egg sandwiches were available for analysis.

Microbiological results

The ACT Government Analytical Laboratory isolated Staphylococcus aureus from the noodle in significant amounts

(4×10^7), and Bacillus cereus in smaller amounts (3.2×10^3). The significance of the B Cereus is not certain; the amount may be insufficient to cause an outbreak. A swab from the nostril of the cook who prepared the noodle dish, taken three days after the outbreak, grew Staphylococcus aureus. Phage typing of the organism is currently under way from both these isolates. Swabs taken from the two students who made the egg sandwiches did not yield Staphylococcus aureus or enteric pathogens. Stool samples collected from 8 cases nearly 72 hours following the outbreak were negative for Staphylococcus aureus or Bacillus cereus. No organisms were isolated from these samples.

Food Handling

The kitchen of the cook who prepared the noodle dish and the egg sandwiches was visited by Environmental Health Officers from the Public Health Branch of the ACT Board of Health on 21/1/92 and 30/1/92. The kitchens were physically clean but the method of food handling, storage and transportation to the church on the day of the outbreak were questionable. The practice of handling boiled noodles with bare fingers and leaving them unrefrigerated overnight was thought to be the factor contributing to the contamination and colonisation of Staphylococcus aureus. This was further compounded by carrying the cooked noodles in a car to the church and allowing it to stand at room temperature in the hall for several hours before consumption. Similar practices were noted for the egg sandwiches. The

ambient temperature on the day of the outbreak was 26 degree Celsius which is an ideal temperature for bacterial growth. Examination of the food handlers did not reveal any infected lesions on their hands.

DISCUSSION

Food poisoning in the ACT has been reported previously in CDI, but no organisms were identified as the causative agent (1). This is the first food borne outbreak investigation in the ACT in which a causative agent was isolated. Staphylococcus food poisoning is a common cause of gastroenteritis. The classical symptoms are those exhibited in this outbreak, with vomiting the main feature. Typically, the incubation period is short, and patients do not present with a fever (2). The Centers for Disease Control estimate that 23% of all foodborne outbreaks are caused by Staphylococcus disease (3). The duration of the illness is short, so the investigation must be performed at the earliest possible time, and the suspect food isolated, refrigerated and kept for analysis in the appropriate manner (4). Stool or vomitus from affected individuals should also be collected as soon as possible from affected individuals. Outbreaks of Staphylococcal food poisoning are typically associated with improper storage of food and poor hygiene of food handlers. Storage of foods at refrigeration temperatures would prevent most outbreaks.

Acknowledgments:

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Dr Robert Scott, Chief Health Officer, ACT Board of Health.

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Mr Brad Duck, Government Analyst, ACT Government Analytical Laboratory.

REFERENCES

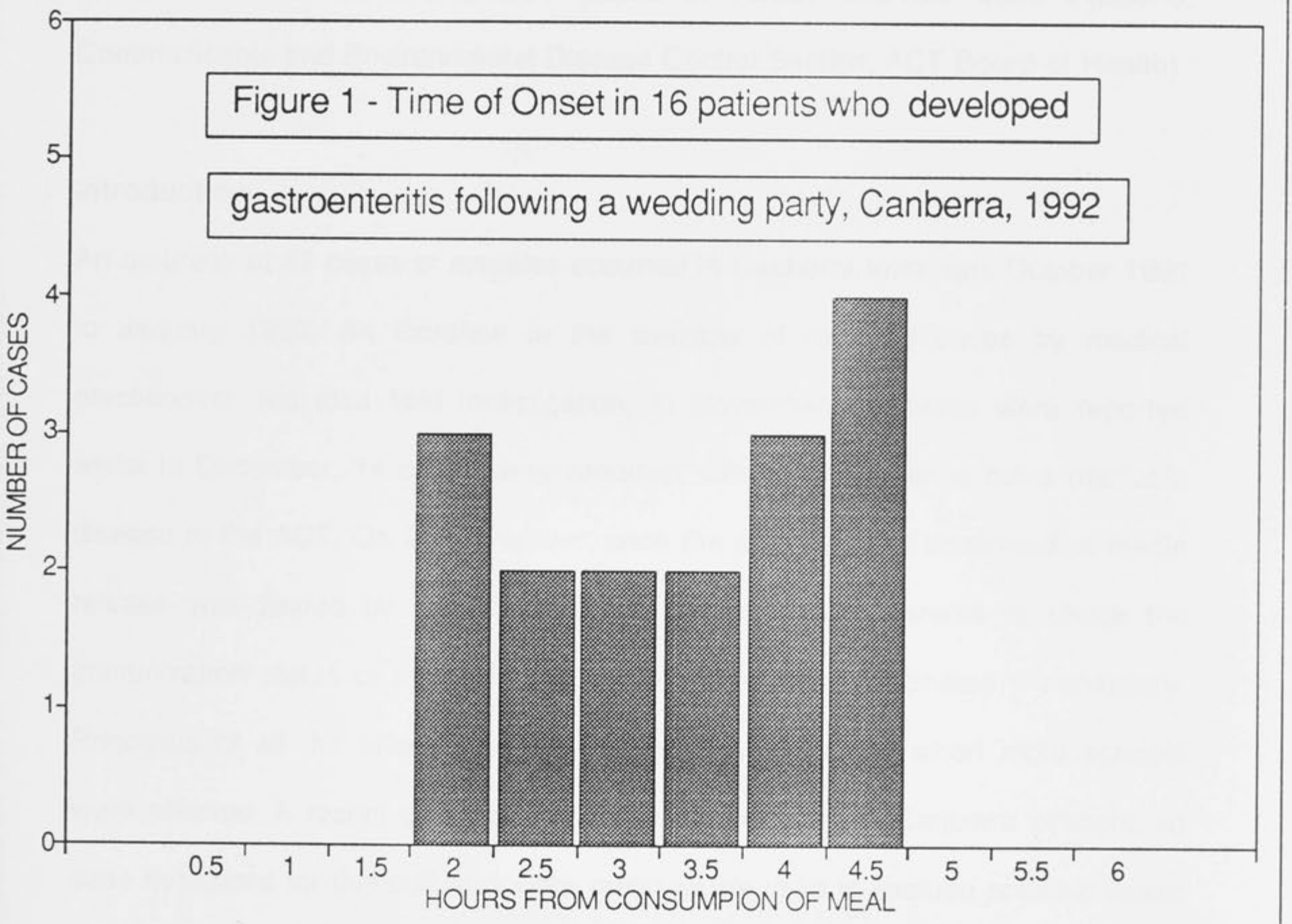
1 Anon. Suspected Bacillus Cereus food poisoning outbreak. *Communicable Diseases Intelligence.* 1990 **9**:4-5

2 Mandell G L, Douglas R D, Bennett J E. (Ed) *Principles and Practice of Infectious Diseases.* 3rd Ed. Churchill Livingstone. New York.1990.

3 Levine W C, Smart J F, Archer D L, Bean N H, Tauxe R V. Foodborne disease outbreaks in Nursing Homes, 1975 through 1987. 1991. *Journal of the American Medical Association.* **15**;2105-2109.

4 Centers for Disease Control. Recommendations for collection of laboratory specimens associated with outbreaks of gastroenteritis. *MMWR* 1990; (No.RR-14):[inclusive page numbers]

Figure 1 - Time of Onset in 16 patients who developed gastroenteritis following a wedding party, Canberra, 1992



MEASLES OUTBREAK IN CANBERRA - OCT TO DEC 1991

(Dr David Cheah, Epidemiology Registrar, Communicable Diseases Section, Commonwealth Department of Health, Housing and Community Services, Dr R Scott, Chief Health Officer, ACT Board of Health and Ms Irene Passaris, Communicable and Environmental Disease Control Section, ACT Board of Health)

Introduction

An outbreak of 82 cases of measles occurred in Canberra from late October 1991 to January 1992. An increase in the average of reported cases by medical practitioners, led to a field investigation. In November, 11 cases were reported whilst in December, 14 cases were reported, although measles is not a notifiable disease in the ACT. On 24 November, once the outbreak was confirmed, a media release was issued by the Chief Health Officer, asking parents to check the immunisation status of their children, and to have them vaccinated if necessary. Principals of all the affected schools received a fact sheet when more schools were affected. A recent outbreak of rubella had occurred in Canberra schools, so case definitions for this outbreak were meticulously used to exclude possible cases of rubella.

Methods

We devised a standardised questionnaire to study the outbreak. Data obtained included demographic characteristics, clinical details, school data and vaccination status. These were entered into Epi Info for analysis. The case definition was

derived from the *Canadian Communicable Disease Surveillance System* (1) :

- a "confirmed" case was one with detection of measles specific antibody in the serum.

- all "clinical" cases had to have : fever greater than 38.3 degrees Celsius, cough, coryza or conjunctivitis, followed by a generalised maculopapular rash for at least three days.

- "confirmed" cases must be linked to other cases in cluster outbreaks.

We sought to identify all the cases in the outbreak by active case finding. We identified contacts of reported cases, contacted general practitioners in suburbs where cases occurred, interviewed principals of primary and secondary schools of cases, interviewed cases or their families who reported. The media release of November 24th advised new cases to contact the Communicable and Environmental Disease Control Section of the ACT Board of Health. We questioned students and their parents about their immunisation history. We accepted their history without further documentation through medical records. Considerably publicity about school immunisation records made us feel that most families knew their immunisation status.

Results

Eighty two patients fulfilled the case definition. Ten cases could not be contacted despite vigorous attempts. We excluded eight reported cases from analysis because they did not conform to the case definition, or because they were suspected of having other types of viral illnesses. Sixty four cases (78%) fulfilled the clinical criteria, and eighteen cases (22%) were confirmed by serology. Another

five cases had blood taken for analysis, but the sera were lost or found to be inadequate. The male to female ratio was 1.28 : 1.

The outbreak curve is presented in Figure 1. The outbreak occurred over October to the end of December 1991, when case ascertainment ceased. Eight cases occurred in October, fifty in November, and twenty four in December. Approximately four generations of transmission of the disease seem apparent in the outbreak curve. The number of cases peaked over late November and early December, and declined over December. The school holidays provided a natural break to the transmission of the disease. Sporadic cases continued to occur over the school holidays, with seven cases reported in January 1992.

Twenty four cases (30.4%) occurred in nine primary schools and fifty two cases (58.7%) were from ten secondary schools. Five cases were preschoolers. The primary schools were located all over Canberra whilst all the high schools were from the north side of the city. Among the 52 high school children, eleven cases occurred in Grade 9. Of the six high schools, one (LH) had twenty three cases (28% of total). This school had an overall attack rate of 28 per 1000, with the highest in Grade 9 (see Table 1). Confirmed cases were identified in four of the six high schools with the most cases.

Table 1- Measles Attack rates by Grade in one Canberra High School, Oct-Dec,1991

Grade	No cases (%)	Population	Attack Rate/1000
Grade 7	3 (13)	194	15
Grade 8	8 (34.8)	207	39
Grade 9	9 (39.1)	208	43
Grade 10	3 (13)	209	28
Total	23 (100)	818	28

We could not identify a definite index case. The first few cases occurred in a primary school, two weeks after a school camp. The missing index case probably infected the initial cases in this school. The first few secondary school cases occurred in three schools within three days of each other, in early November. Secondary spread from primary to secondary schools, and to other schools presumably occurred through family clusters with children in multiple schools.

Thirty nine cases (47%) belonged to fifteen family clusters. Four families had virologically confirmed cases within the family. Each family had the clinical diagnosis made by their family physicians in at least one member of their family. Three suburbs in Canberra, where the high schools were located, accounted for 43% of cases.

Teenage high school students accounted for 84% of all cases (see Fig 2). Females predominate in the ten to fourteen age group (57%) whilst males

predominate in the fifteen to nineteen age group (80%). Overall, males (56%) accounted for more cases than females (44%). In the under ten age group, male and female cases were roughly equal.

Symptoms derived from the case definition are listed in Table 2. The disease was diagnosed mainly by general practitioners on clinical grounds alone (65%), and in six cases by the parents of the affected children (7%). Four of these children belong to one family cluster; the other two were contacts of cases in a high school (LH). 39% of all cases gave a history of previous vaccination as compared with 55% of all confirmed cases (see Table 3). Three cases were hospitalised due to complication of the disease, one with pneumonia, one with asthma and one with dehydration. A further three cases were referred to a hospital for treatment but were not hospitalised. In those cases who had the disease before the onset of school holidays, an average of seven days was lost from school attendance. 47.6% of the cases were given antibiotics by their general practitioners.

Table 2 - Symptoms of the 82 affected children in the measles outbreak, Canberra, Oct-Dec 1991.

Symptoms	Number of cases	Percent
Fever	80	97.6
Cough	79	96.3
Runny nose	57	69.5
Conjunctivitis	54	65.9
Maculopapular rash	82	100

Table 3 - Vaccination status of the 82 affected children in the measles outbreak, by sex, Canberra, Oct-Dec 1991. (percentage in brackets)

	Vaccination Status			
Sex	Vaccinated	Not vaccinated	Unknown	Total
Males	17 (37)	29 (63)	0	46
Females	15 (42)	18 (50)	3 (8)	36
Total	32 (39)	47 (57)	3 (4)	82

Discussion

This is the first significant measles outbreak of school children in Canberra since the analysis of notifications in 1990 (2). Other recent Australian outbreaks have occurred in New South Wales, South Australia, and Western Australia (3,4,5). In most of these outbreaks, school children were involved and preventive measures by medical authorities were necessary to control the outbreak. Early reporting of the disease by medical practitioners is critical to control measures. The control of a measles outbreak depends on the rapid immunisation of susceptible children. In this outbreak, a media release was issued, both in the print and electronic media, to the community as soon as the outbreak was confirmed. The Centers for Disease Control recommends the following measures in outbreaks (6,7,8). They can be modified to local needs.

1 prompt investigation of outbreaks and control activities. This should not be delayed whilst awaiting for serological confirmation.

2 revaccination program for susceptible, those without documentation, and for those who are uncertain of their vaccination status.

3 persons who have been exempted from measles vaccination for medical, religious or other reasons are to be excluded from the outbreak area until at least two weeks after the onset of rash in the last case of measles.

4 consideration for a revaccination program in unaffected schools that may be at risk of measles transmission.

5 for those with contraindications to the measles vaccine, consideration should be given for passive immunisation with immunoglobulin, at 0.25ml/kg body weight.

In Australia, as in the United States, a resurgence of measles is taking place. Outbreaks of measles should be meticulously investigated so as to provide data for making immunisation policy. In this outbreak, as in the United States, almost half of all the cases occurred in unvaccinated children. This probably indicates that there is high vaccine coverage in those school population (9). Measles, a vaccine preventable disease, still causes significant morbidity among affluent groups in Australia. A two dose vaccination program is currently being considered by the National Health and Medical Research Council.

As a follow up investigation of the outbreak, a vaccine efficacy study is now currently under way in one high school (LH). This will provide valuable insights for the cause of the outbreak, and help document the vaccine efficacy in older children who were immunised as pre schoolers.

Acknowledgments:

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The Accident and Emergency Department, Calvary Hospital.

References

1 Canadian Communicable Disease Surveillance System. Disease Specific Case Definitions and Surveillance Methods. Vol 1753. 1991.

2 Scott R J, Passaris I. Measles notifications received in the ACT - January to October 1990. Communicable Diseases Intelligence. 1990 25;8-9.

3 Taylor L Catching a measles outbreak. NSW Public Health Bulletin. 1991 7;65-69

4 Weinstein P, Carrangis J. Measles resurgence in South Australia. Communicable Diseases Intelligence. 1991 15;312-313.

5 Gill J, Marshall L. Measles outbreak in Collie, Western Australia. Communicable Diseases Intelligence. 1991. 15;150-151.

6 The National Vaccine Advisory Committee. The Measles Epidemic. Journal of the American Medical Association. 1991. 266;1547-1552.

7 Centers for Disease Control. Measles prevention : recommendations of the Immunisation Advisory Committee (ACIP) MMWR 1989;38(no.s-9).

8 Centers for Disease Control. Update on Adult Immunisation : recommendations of the Immunisation Practices Advisory Committee (ACIP) MMWR 1991;40(no. RR-12)

9 Anon. Measles in New South Wales. Communicable Diseases Intelligence. 1991. 13;208-209

Figure 1 - Measles Outbreak, Canberra, October - December, 1991

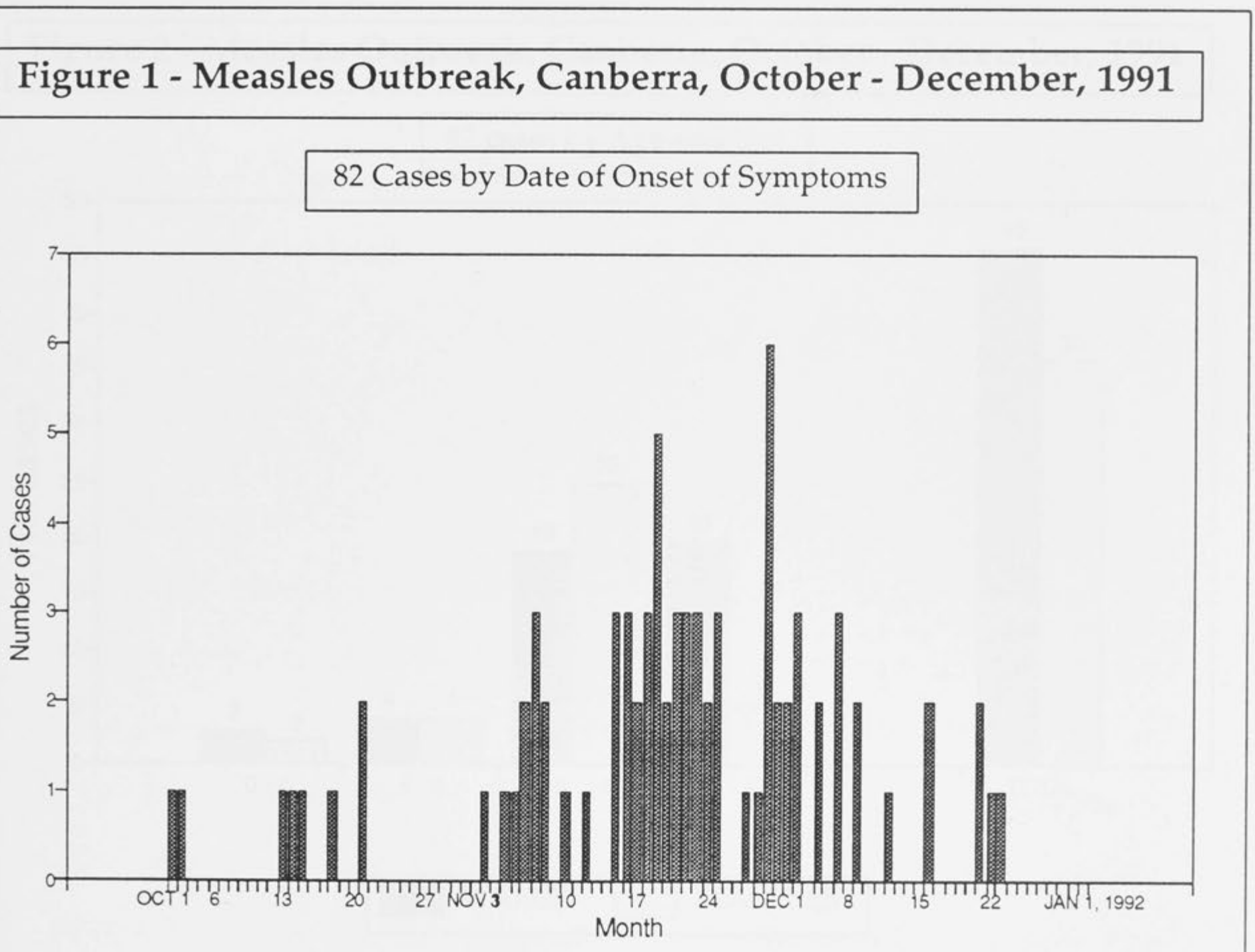
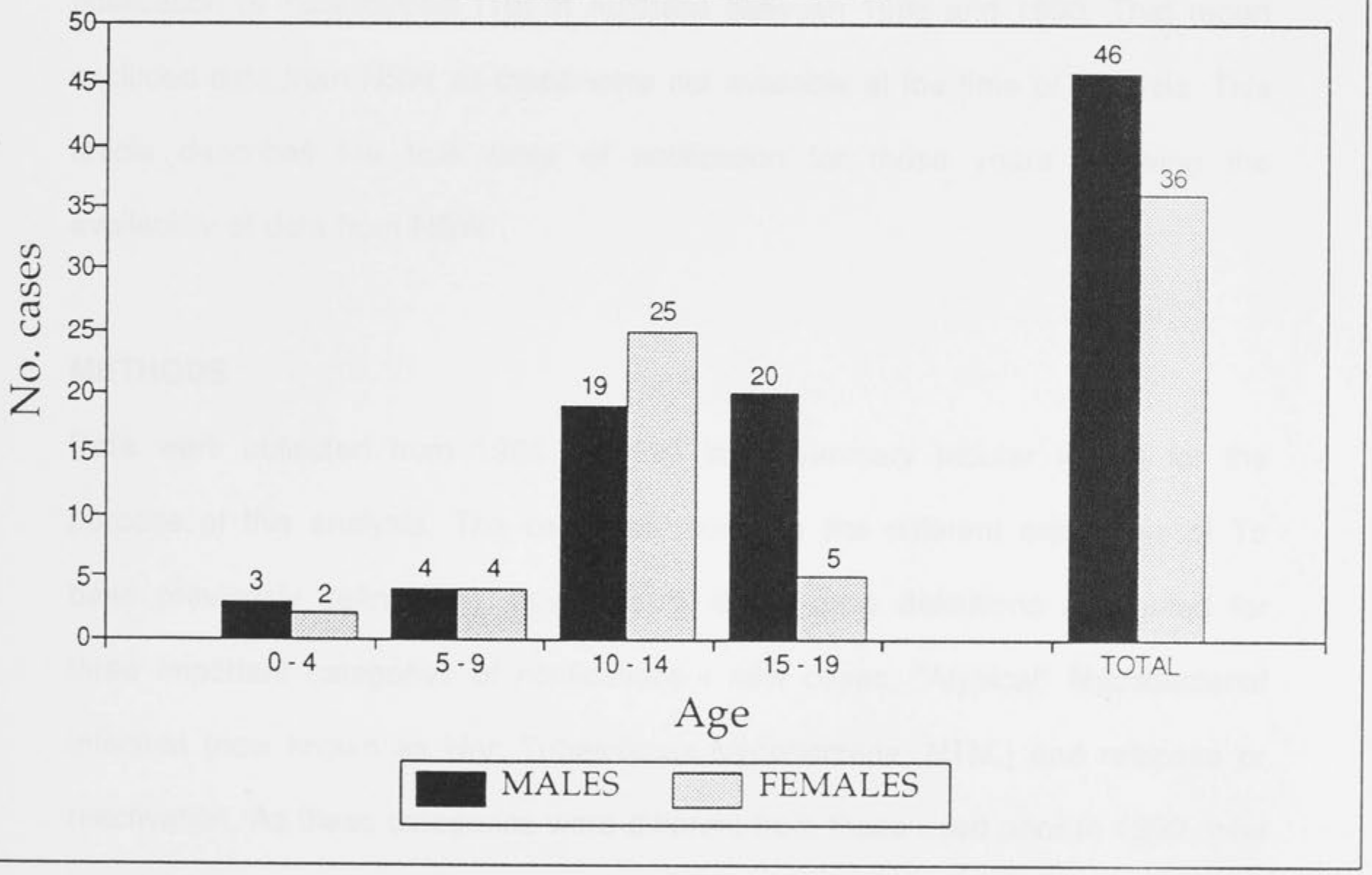


Figure 2 - Measles Outbreak, Canberra, October - December, 1991



TB NOTIFICATION RATES IN AUSTRALIA : FINAL DATA, 1986 - 1990

(Dr David Cheah, Epidemiology Registrar, Communicable Diseases Section, Commonwealth Department of Health, Housing and Community Services, Woden, ACT.)

INTRODUCTION

In August 1991, the *Communicable Diseases Intelligence* reported the rates of notification of Tuberculosis (Tb) in Australia between 1986 and 1990. That report excluded data from NSW as these were not available at the time of analysis. This article describes the true rates of notification for those years following the availability of data from NSW.

METHODS

Data were collected from 1986 to 1990 in a summary tabular format for the purpose of this analysis. The case definitions for the different categories of Tb been previously defined (1). In summary, these case definitions accounted for three important categories of notifications : new cases, "Atypical" Mycobacterial Infection (now known as Non Tuberculous Mycobacteria, NTM.) and relapses or reactivation. As these categories were different from those used prior to 1990, new data had to be collected from many states which had provided data in the old format of reporting. The final data collected were analysed according to the 1991 case definitions. Data for relapse cases of Tb refer to M Tb complex only and do not include NTM. Denominator populations were supplied and incidence rates calculated from Australian Bureau of Statistics data.

RESULTS

The true rate of notification for new cases of Tb has shown a slight upward trend since 1986, from 5.39 to 5.73 in 1990 (Figure 1).

Table 1 - Notification rates for new cases of Tuberculosis and for Non Tuberculous Mycobacteria ("Atypical" Disease), 1986 - 1990.

	Tuberculosis			Non Tuberculous Mycobacteria		
Year	Cases	Rate	%Change from previous year	Cases	Rate	%Change from previous year
1986	863	5.39		207	1.29	
1987	868	5.34	+0.6	162	1.00	-21.7
1988	925	5.59	+6.6	215	1.3	+32.7
1989	902	5.36	-2.5	368	2.12	+71.2
1990	979	5.73	+8.5	385	2.25	+4.6

* Rate per 100,000

This is not a dramatic variation from the previously published adjusted data which excluded NSW. The rate of notification for Non Tuberculous Mycobacteria (NTM) shows a significant upward trend since 1986. The previously adjusted rate for 1990 (1.86 per 100,000), is well below the true rate for 1990 (2.25 per 100,000), underlying the significance of data from NSW in the calculation of rates for this

disease.

The rate of notification of new cases plus relapse cases of Tb and deaths remained largely unchanged from the previously published data (Figure 2).

Table 2 - Notification rates for new cases plus relapses and deaths

Year	No Cases	Rate*	Deaths	Rate*
1986	906	5.65	52	0.32
1987	907	5.58	68	0.42
1988	954	5.77	60	0.49
1989	952	5.66	52*	0.42
1990	1016	5.95	56*	0.45

* Rate per 100,000 population per year

* Data on deaths not kept in Vic, Act in 1989 and 1990, death rate adjusted accordingly.

DISCUSSION

The analysis of notification rates for Tb is difficult for a variety of reasons. These include the problem of lack of historical consistency of the collection of data, availability and reliability of previously collected data and changes to the data

following collection. For example, there is no consistent case definition for non tuberculous mycobacteria, hence the reported data may not represent the true rates for the spectrum of disease. Data on infections due to Mycobacterium Bovis-BCG are not routinely collected in some States. However, these problems of under representation are encountered in other national data collection systems too and are not unique to Tuberculosis.

The percentage change of cases, when compared with the previous year, needs to be interpreted with caution. This is a sensitive indicator. In Australia, with the relatively small numbers reported, small changes in reported numbers result in large percentage changes. In the United States, where there are large numbers reported, a small percentage change would indicate a large number of cases.

The rate of notified new cases of Tb has been fairly constant at between 5.73 and 5.34 per 100,000 over the last five years, despite yearly fluctuations, when compared with the United States. There a steadily increasing trend since 1985 is noted (2). Prior to 1985, the United States has shown a 5% decrease of reported cases annually.

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REFERENCES

1 Tuberculosis in Australia - Notification Rates. CDI 1991; 15:267-269

2 Centers for Disease Control. CDC Surveillance Summaries, December 1991. MMWR 1991:40(no. SS-3) [inclusive page numbers]

Figure 1 - Tuberculosis rate in Australia, 1986 - 1990

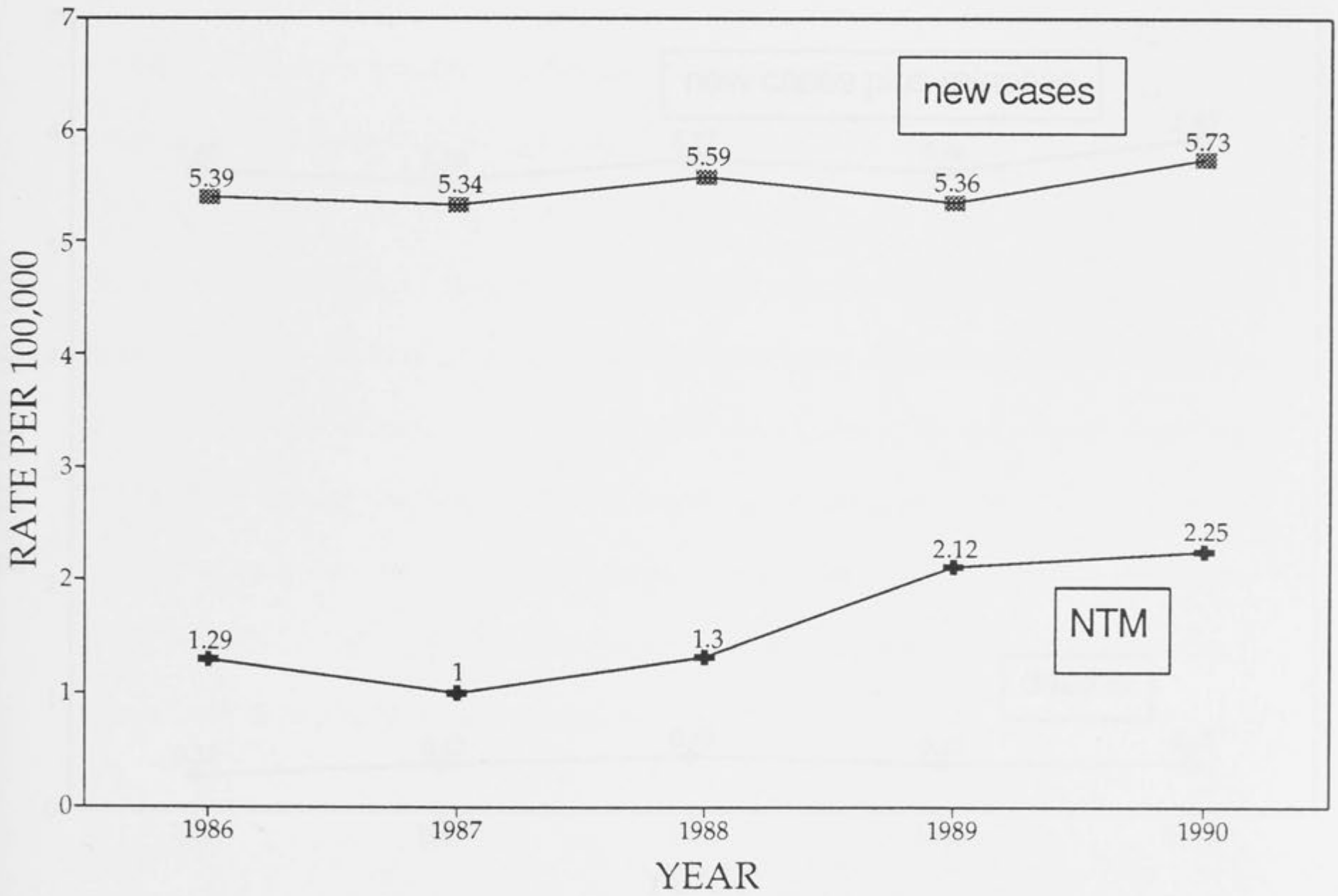
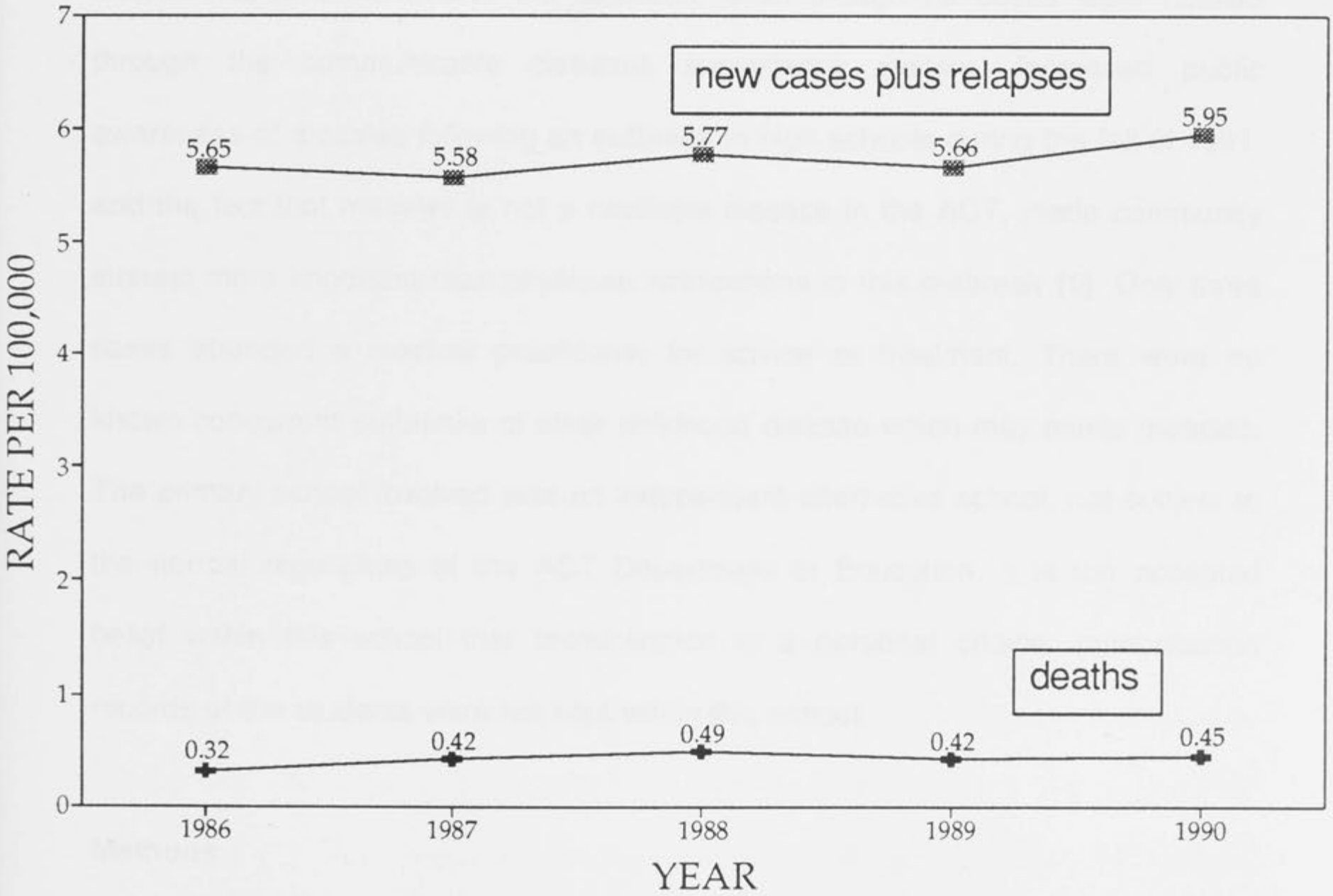


Figure 2 - Tuberculosis rates in Australia, 1986 - 1990



AN ESTIMATE OF MEASLES VACCINE EFFICACY IN A CANBERRA PRIMARY SCHOOL

Introduction

An outbreak of measles occurred in a south side primary school in Canberra between January and March 1992. Concerned individuals within the community alerted health authorities to the outbreak, even though no cases were notified through the communicable diseases surveillance system. Increased public awareness of measles following an outbreak in high schools during the fall of 1991, and the fact that measles is not a notifiable disease in the ACT, made community interest more important than physician notifications in this outbreak (1). Only three cases attended a medical practitioner for advice or treatment. There were no known concurrent outbreaks of other childhood disease which may mimic measles. The primary school involved was an independent alternative school, not subject to the normal regulations of the ACT Department of Education. It is the accepted belief within this school that immunisation is a personal choice. Immunisation records of the students were not kept within this school.

Methods

We devised a standardised questionnaire to survey the whole school population once the outbreak was identified. The outbreak was over, but opportunity existed for a vaccine efficacy study. The school principal agreed to the survey, but insisted upon anonymity of responses, an option for non responding and no follow up of non responders.

There were 151 children in seven grades, with an average of 21 children in each grade. The Kindergarten grade also had children who came to the school from time to time for occasional sessions. The questionnaire documented age, sex, diseases status, methods of vaccination and vaccination status. We accepted as a case of measles any child considered to have measles by doctors, parents or teachers. Serological confirmation was not possible under the constraints of the survey. We accepted a history of vaccination without viewing records; many of the children came from outside of the ACT.

Results

Cases occurred in this outbreak between 16 February and 11 April 1992 (Figure 1). We received 103 full responses (68.2%), one incomplete response and two refusals (total = 108). We were surprised by the response rate and the quality of data from those who did responded. However, despite our reassurances, we were able to ascertain a degree of apprehension about the survey in the school.

There were 38 cases of measles, for a crude attack rate of 37.2 per 100. Twenty one cases were females (attack rate = 42.8 per 100) and 17 cases were males (attack rate = 32.1 per 100). The majority of cases occurred in the five to nine year age group (73.7%). No case occurred in those who had a history of measles vaccination. All the cases occurred in the unvaccinated group. In four children who were vaccinated by alternative homoeopathic methods, two developed measles. Only 5 cases of measles were clinically confirmed by a medical practitioner, the rest were confirmed by their parents with or without consultation with their teacher (1 case), a nurse (1 case) and their homoeopaths (5 cases). One case was

diagnosed not to be measles by their medical practitioner.

Table 1 - Characteristics of a measles outbreak in a primary school, Canberra, 1992.

Class/ Grade	No. cases	AR* per 100	% Immunised	AR*/100 Unimmunised
Kindy	8	38.1	42.9	66.7
Gr. 1	7	50	35.7	77.8
Gr. 2	6	37.5	43.7	66.7
Gr. 3	7	50	28.6	70
Gr. 4	2	22.2	44.4	40
Gr. 5	4	28.6	50	57.1
Gr. 6	4	28.6	42.9	50
Total	38	37.2	41.2	53.3

*AR = Attack Rate in respondents.

We analysed vaccine efficacy rates, mindful of the potential for biases which are inherent in the sampling framework. Vaccine efficacy (VE) was calculated with the following formula (2,3):

$$VE(\text{percent}) = [(ARu - ARv) / ARu] \times 100$$

where ARu is the attack rate in the unvaccinated and ARv is the attack rate in the vaccinated.

Table 2 presents the attack rates and vaccine efficacy for five year age groups.

Table 2 - Vaccine Efficacy for Measles in a Primary School, Canberra, 1992.

Age group	No. cases		AR*/100	VE*
	Males	Females		
0 - 4	2	0	50	100
5 - 9	12	16	40.6	100
10 - 14	7	1	27.6	100
Total	21	17	37.2	100

*AR = Attack Rate in respondents

*VE = Vaccine Efficacy in respondents

Discussion:

This study provides an estimate of vaccine efficacy for measles. In interpreting the data, it is important to note the sources of bias. Firstly, no attempt was made to

validate vaccination status through viewing the records. Secondly, serological confirmation was not possible, due to the constraints of the study. Many cases of measles may have been misdiagnosed by non medically qualified people. It is likely that the number of cases is exaggerated which may lead to increased attack rates. Ideally a case of measles should fulfil a case definition for measles. However, measles can be assumed as there were no other outbreaks of childhood diseases which may mimic measles.

This study demonstrates the value of immunisation and shows that the protection of children from the disease can only be achieved by a high vaccine coverage rate. A figure of at least 90% is required to provide herd immunity against measles (4). Here, a significant proportion of children remain unprotected against measles because of religious or philosophical beliefs of their parents. In the United Kingdom, vaccine coverage for measles is showing an increasing trend, with a prediction that in 1995, 97% of the children will be immunised against measles (4). In Australia, these data are difficult to obtain. A national vaccination strategy should address this small but significant group of children in our community.

Acknowledgment:

The author of this article would like to acknowledge the help provided by the Principal of the school studied.

References:

1 D Cheah, I Passaris, R Scott. Measles outbreak in Canberra. Communicable Diseases Intelligence. Vol 16;6:114-117.

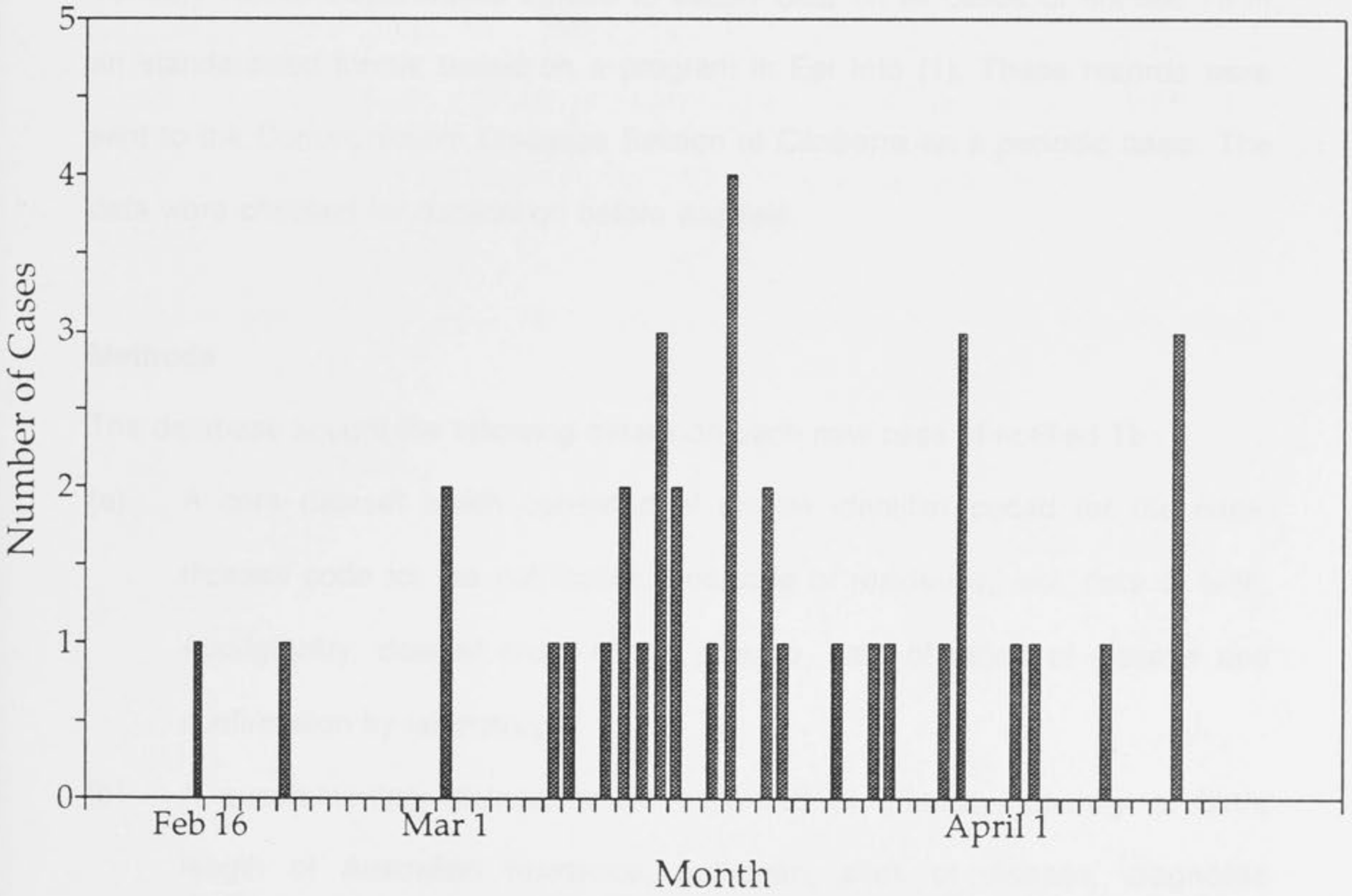
2 Measles outbreak in Kampala. Weekly Epidemiological Record. 49:364-367.

3 SE Robertson, LE Markowitz, DA Berry, EF Dini, WA Orenstein. A Million Dollar Measles Outbreak : Epidemiology, Risk Factors, and a Selective Revaccination Strategy. Public Health Reports. Vol 107;1:24-31.

4 JM White, SJ Gillam, NT Begg, CP Farrington. Vaccine coverage:recent trends and future prospect. British Medical Journal. Vol 304;682-4.

5 VK Tohani, FD Kennedy. Vaccine efficacy in a measles immunisation programme. Communicable Disease Report. Vol 2;5:59-60.

Figure 1 - Measles Cases by date of onset of symptoms



TUBERCULOSIS NOTIFICATION RATES, AUSTRALIA ,1991.

David Cheah for the Communicable Disease Network (Australia)

Introduction

In 1991, the surveillance system for tuberculosis (Tb) was revised under the auspices of the Communicable Disease Network (Australia). All States and Territory Health Departments agreed to supply data on all cases of notified Tb in an standardised format based on a program in Epi Info (1). These records were sent to the Communicable Diseases Section at Canberra on a periodic basis. The data were checked for duplication before analysis.

Methods

The database sought the following details on each new case of notified Tb :

(a) A core dataset which consisted of unique identifier coded for the case, disease code for the notification, postcode of residence, sex, date of birth, Aboriginality, date of onset of the disease, date of report of disease and confirmation by laboratory.

(b) A supplementary dataset which consisted of ethnicity, country of birth, length of Australian residence, pathogen, sites of disease, diagnostic method, medications at the time of notification, BCG vaccination status, HIV status and whether the case was a relapsed case.

The case definition for the different categories of tuberculosis remain unchanged from those used in previous analysis (2). Cases were recorded to the end of 1991

with the final case number not finalised until June 1992 to ensure complete accounting of cases by the State and Territory Health Departments.

Results

Analysis was not performed on medications at time of notification, BCG status and HIV status because of incomplete data.

There were 903 new cases of M Tb notified in Australia, a decrease of 7.8% from the 1990 figure of 979 cases. This gives a rate of 5.21 per 100,000 for the year, compared with 5.73 per 100,000 in 1990 (Table 1). The rate for new cases of M Tb has remained fairly constant during the last five years, in Australia (3).

Table 1 - Notification rates for new cases of Tb*, in Australia, 1986 to 1991, by year

Year	Cases	Rate	% Change in Rate from previous year
1986	863	5.39	
1987	868	5.34	-0.9
1988	925	5.59	+4.7
1989	902	5.36	-4.1
1990	979	5.73	+6.9
1991	903	5.21	-9.1

* Rate per 100,000 * M Tb Complex (not including bovis-BCG)

NSW has the highest proportion of cases (42.9% of total) and ACT the lowest (Table 2). Victoria, South Australia, Western Australia, Tasmania, Northern Territory and the ACT reported a decline in cases, compared with 1991, with Northern Territory showing the greatest decrease (51.7%). Two States, NSW and QLD, reported increases in the number of cases.

Table 2 - Notification rates for new cases of Tb by States/Territories, 1991.

State/ Territory	No of Cases Notified	Rate*	% Change in Rate from Previous Yr.
NSW	388	6.58	+10.8
VIC	226	5.1	-12.4
QLD	99	3.33	+4.1
SA	61	4.19	-29.1
WA	83	4.98	-31
TAS	9	1.95	-19.1
NT	29	18.26	-52.1
ACT	8	2.73	-29.3
AUSTRALIA	903	5.21	-9.1

* Rate per 100,000 per year

In 1991, 44% of notified cases of Tb occurred in females and 56% in males (Table 3). The 25 to 34 age group accounted for 17.6% of total cases (159 cases) whereas 13.4% of total cases occurred in the greater than 75 year old age group (121 cases). Males predominate in the greater than 65 age group, accounting for 61.5% of cases, whilst females accounted for 38.5% of cases.

Table 3 - Notification of new cases of Tb in Australia by sex and 5 year age group, 1991.

Age Group	Female	Male	Total
0 - 4	17	20	37
5 - 14	19	14	33
15 - 24	53	42	95
25 - 34	82	77	159
35 - 44	56	68	124
45 - 54	41	53	94
55 - 64	28	70	98
65 - 74	48	67	115
>75	43	78	121
Unknown	10	17	27
Total	397	506	903

Pulmonary or pleural site accounted for 67.7% of all the cases. Lymphatic site was the most common extrapulmonary site, accounting for 55.9% of all cases. Males predominate in pulmonary disease whilst females predominate in lymphatic disease (Figure 1).

In 1991, 90% of notified cases have data on the results of culture performed. Of these, 74.7% were bacteriologically positive (Table 4). This estimate of culture positivity ranges from 54.1% in SA to 92.1% in Victoria.

Table 4 - Percentage of culture positive cases by State, Australia, 1991.

State	Culture +ve	Culture -ve	Unknown	% of culture +ve cases
NSW	231	89	68	72.2
VIC	197	17	12	92.1
QLD	67	32	0	67.7
SA	33	28	0	54.1
WA	45	28	10	61.6
TAS	8	1	0	88.9
NT	21	8	0	72.4
ACT	5	3	0	62.5
Total	607	206	90	74.7

In 1991, 66% of cases were foreign born, whilst 34% were Australian born (Table 5). The proportion of foreign born cases has declined slightly from 1990, where 70.4% of total cases were foreign born.

In 1991, 47 cases of notified tuberculosis were recorded as Aborigines, with 44.7% (21 cases) occurring in the Northern Territory.

Table 5 - Notification of new cases of Tb, by place of birth, 1991.

Birthplace	Cases	% of Total	Rate*
Australia	307	34	2.3
Overseas	596	66	15.1

* Rate per 100,000.

* Birthplace denominators were obtained from the Australian Bureau of Statistics.

Discussion

The analysis of notified data for Tb in 1991 indicates that the rates have been stable since the mid 80's. The lack of increase in notifications is encouraging when compared with the United States, which has shown increases since the mid 80's, accounting for more than 28,000 "excess" cases since 1985 (4). The majority of cases of Tb in Australia occur in immigrants, with 66% of all reported cases being in foreign born populations, accounting for an estimated rate of 15.1 per 100,000.

This is a decrease from 1990, where 70.4% of all reported cases were foreign born (5). In the United States, foreign born notifications account for only 22% of all reported cases and the rate of tuberculosis for foreign born is 124 per 100,000 (6). . The site of disease and age group of notified cases has not changed significantly from the previous analysis. Seventy five percent of cases were bacteriologically confirmed in 1991 compare with 61.7% in 1985 (7). Further characterisation of the disease pattern is indicated for the other "at risk" groups in the community, for example the homeless, those in institutions and those with HIV infection.

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References

1 Dean AD, Dean JA, Burton JH, Dicker RC. Epi Info, Version 5:a word processing, database, and statistic program for epidemiology on microcomputers. Centers for Disease Control, Atlanta, Georgia, U.S.A., 1990.

2 Tuberculosis Briefs 1 - Notification Rates. Comm Dis Intell 1991;15:267-269.

3 Cheah D. Tuberculosis Notification Rates, Australia - Final Data for 1986 to 1990. Comm Dis Intell 1991;16:234-235.

4 Centers for Disease Control. National action plan to combat multidrug-resistant tuberculosis;Meeting the challenge of multidrug-resistant tuberculosis:summary of a conference;Management of persons exposed to multidrug-resistant tuberculosis. MMWR 1992;41(No. RR-11):[inclusive page numbers].

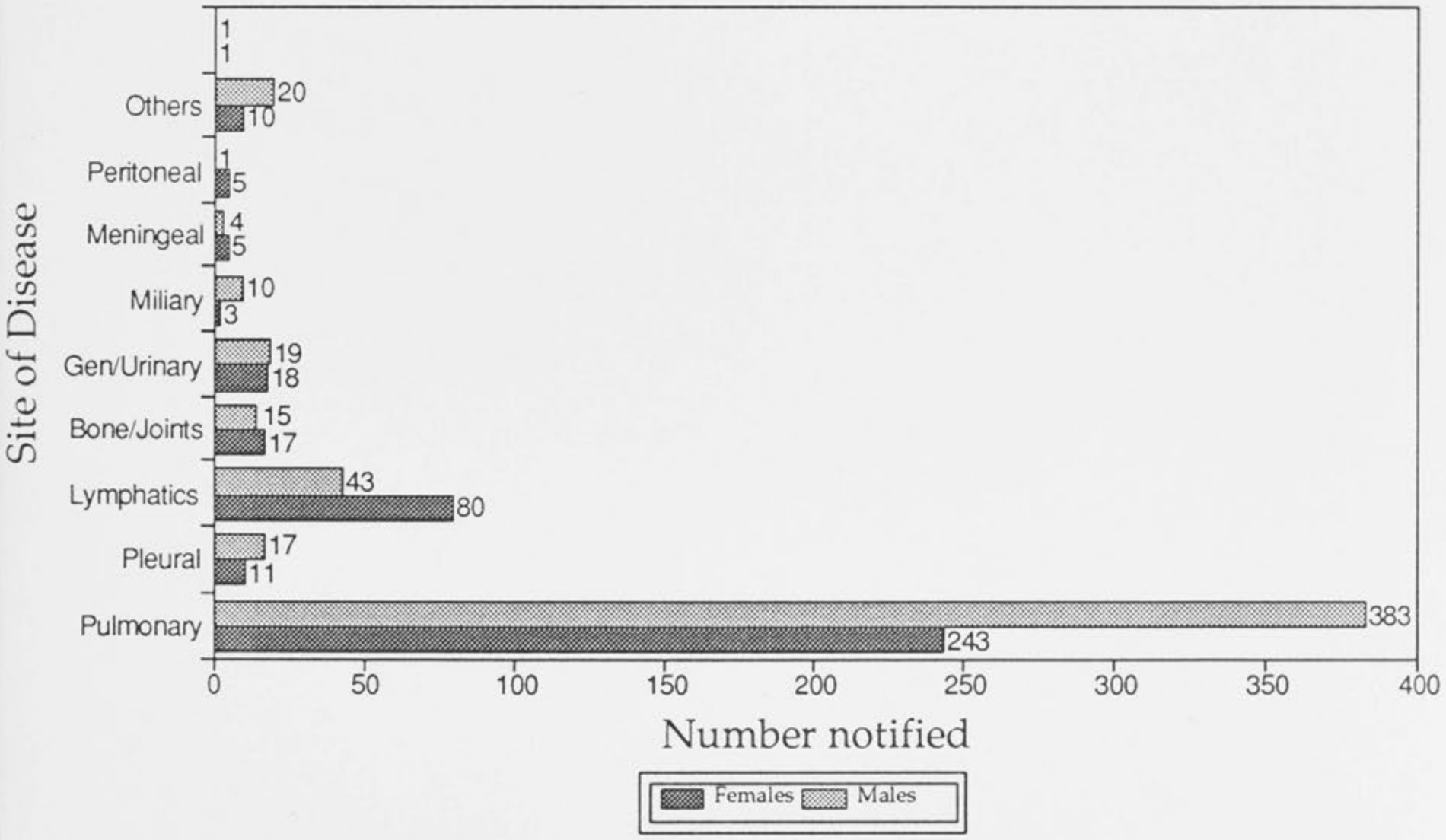
5 Tuberculosis Briefs 2 - An Analysis by Country of Birth. Comm Dis Intell 1991;15:440-442.

6 Centers for Disease Control. Tuberculosis Among Foreign-Born Persons Entering the United States:recommendations of the Advisory Committee for Elimination of Tuberculosis. MMWR 1990;39(No. RR-18)

7 Tuberculosis Statistics for year ended 31 December 1985. Commonwealth Department of Health.

Figure 1 - Tuberculosis in Australia, 1991

By Sex and Sites of Disease



SECTION 3

SECTION 3 PAPERS PRESENTED IN SCIENTIFIC MEETINGS

I presented three papers during the course of the MAE programme. These were :

1 **"Australian Tuberculosis Reporting System : Cases recorded in the Reference Laboratories, 1989 - 1991."** This paper was presented to a Symposium in Mycobacteriology at the Combined Scientific Meeting and Exhibition of the Australian Society for Microbiology and New Zealand Microbiological Society, held in Sydney between 12 - 17th July 1992. The full text of the presentation is attached.

2 **"Measles Vaccination Efficacy in a Canberra High School : A Study conducted following a measles outbreak."** This paper was presented to the Australian Epidemiological Association Annual Meeting, held in Canberra on 26th September 1992. The full text of the presentation is attached.

3 **"Tuberculosis in Australia, 1986 - 1991 : An Analysis of Notification Data."** This paper was presented to the 24th Annual Conference of the Public Health Association, held in Canberra, between 27 - 30th September 1992. The full text of the presentation is attached.

THE AUSTRALIAN TUBERCULOSIS REPORTING SCHEME

The **Australian Tuberculosis Reporting Scheme** is a reporting scheme for Laboratory based isolates of M Tb in Australia, organised as a joint project by the Commonwealth Department of Health and the Australian Society for Microbiology, in 1991. It has been formed as part of the **Communicable Diseases Network (Australia)** for the purpose of surveillance of Tuberculosis in this country. Data is collated by members of the **Special Interest Group** in Mycobacteria and sent to the **Communicable Diseases Section** in the Commonwealth Department of Health, Housing and Community Services in Canberra for analysis. The data collected for each isolate include :

. Reference Lab and identifiers for each isolate.

. Patient details of Sex, Year of birth, State of residence and HIV status, if known.

Site or sites of the specimen collected, Species of the Specimen and

. Drug sensitivity profile to the commonly used anti tuberculous drug. These drugs are Streptomycin, Isoniazid, Rifampicin, Ethambutol and Pyrazinamide. Other drugs tested can also be added.

Prior to 1991, when this Reporting Scheme was organised, such data were collected independently by the Special Interest Group alone. Their dedication to this collection system must be mentioned and commended upon as for a period of time, surveillance data on the epidemiology of tuberculosis was not available.

Slide (1) shows the contributing Laboratories in this system. Isolates from Alice Springs were sent to SA and those from Darwin, to VIC. Isolates from the ACT were sent to NSW. Tasmania sends their isolates to VIC or WA for testing.

Slide (2) shows the percentage of isolates tested in each Lab. QLD shows an increasing trend whilst SA shows a decreasing trend, probably reflecting the isolates from the NT being sent to Fairfield for testing. In 1991, the total number of isolates tested was 650 and it ranges from 36 isolates in SA, to 248 isolates in NSW.

Slide (3) shows the sites of isolates tested. These are combined data for the three years, 1989 to 1991. In the analysis, specimens are coded into the sites which are consistent with the Notifiable Surveillance System for Tb. Males have a higher preponderance than females to have pulmonary disease whilst females tend to have lymphatic disease. These findings confirmed those of **Dawson et al,** published in Pathology, September 1991. The skin site reflects mainly BCG-BOVIS activity.

The next two slides shows the age group specific rates compared with the rate derived from the Notifiable Surveillance System data. It is important to note that 31 cases in 1989 and 40 in 1989, had missing data. Population denominators for the different age groups were obtained from the **Australian Bureau of Statistics.**

Slide (4) shows the data for 1989. There is a trend which parallel the notifiable surveillance system except in the 0 - 4 age group and the > 75 age group. The 0 - 4 age group shows an aberration in the number of notified cases compared with tested cases. Here, 20 cases were reported and 40 cases were tested positive. The > 75 year old age group shows that all cases notified were positively identified to have M Tb.

Slide (5) shows data for 1990. Here a diverging trend is seen in the 0 - 4 age group, 25 - 34 age group and > 75 age group. Whether this reflects a trend in treating Tb, without laboratory confirmation, is uncertain.

The 1991 age group data from the Notifiable Surveillance System is not completed at this stage for comparison with the Laboratory based system.

The next few slides will present drug resistance patterns for the commonly used anti tuberculous drugs to tuberculosis. M Bovis is included, but not BCG-BOVIS. Note that streptomycin is not tested in all Reference Labs. and the percentages have been adjusted accordingly, for example, in SA and WA, streptomycin was not tested in 1988, 89 and 90, whilst Victoria ceased testing in 1991. Likewise, pyrazinamide was not routinely tested by all Labs., except in Qld and Vic.

Slide (6) shows the percentage of isolates which have resistance to at least one drug from the total isolates tested. There is a declining trend since 1989.

Slide (7) shows the percentage of isolates resistant to **STREPTOMYCIN**, alone by itself or in combination with other drugs. The Y axis indicates percentages of total isolates tested. The numbers in brackets, above the bars indicate the actual number of isolates showing resistance. This shows that there is no increase in resistance pattern, both in the numbers tested and as a percentage of total isolates. In 1991 the percentage of streptomycin resistance was 6.3%, by itself, and 10.7%, in combination with other drugs.

Slide (8) shows the resistance pattern to **ISONIAZID**. An increase in the resistant pattern between 1990 and 1991 is seen, but is less than the increases between 1988 and 1989. Whether this trend continues will be evident in subsequent years. In 1991, the percentage of isoniazid resistance was 5.2%, by itself, and 8.6% in combination with other drugs.

Slide (9) shows the resistance pattern for **RIFAMPICIN**. A decline in drug resistance was seen in 1991, following an increasing trend since 1988. In 1991, rifampicin resistance was 0.5%, by itself, and 1.6%, in combination with other drugs. These numbers are relatively small, when compared with the total numbers of isolates tested.

Slide (10) shows the resistance patterns for **ETHAMBUTOL**. A decreasing trend is seen since 1988. In 1991, there was only 1 isolate resistant to ethambutol.

Slide (11) shows the resistance patterns for **PYRAZINAMIDE**. The data is derived from the Qld and Victorian Labs only, being the only Reference Labs. which routinely tests for pyrazinamide sensitivity. In 1991, the 3 resistant strains were from M Bovis. 1 other strain was an M Tb strain, resistant to five anti tuberculous drug combination.

Slide (12) shows the drug resistant patterns for the different combinations of commonly used drugs. The most frequent seen combination is the Streptomycin/Isoniazid combination. Less than 20 isolates a year shows this pattern, except for 1989. Of concern is the emergence of five drug resistance in successive years, in 1990 and 1991.

These then, are the results to date. The advantages of the **Australian Tuberculosis Reporting Scheme** are that it keeps a check on the Notifiable Surveillance System, any disparity in trends can be identified, as in the age group specific rates of cases. This system is also unique in collecting drug resistance patterns of the isolates.

One should be cautioned against total reliance on this system for the surveillance of tuberculosis as it may give a wrong impression on the epidemiology of the disease in this country. For example, if clinicians are treating more and more patients, based on clinical or other findings, then the number of isolates tested may remain constant, leading to a low rate of isolation and a false impression on the rate of the actual disease. In 1990, the rate of isolation of M Tb was 3.8 per

100,000 whilst the rate of disease notification was 5.73 per 100,000.

In conclusion, the Australian Tuberculosis Reporting Scheme complements the Notifiable Surveillance System. It gives precisely the drug resistance patterns for M Tb isolates, tested in Australian Reference Laboratories. In 1991, drug resistance was found in 15.7% of the total isolates tested, compared with 12.7% of the total isolates tested in 1988. It is imperative that this scheme be continued and that ongoing analysis of these data are forthcoming. Meeting such as this would be the best forum to present such findings.

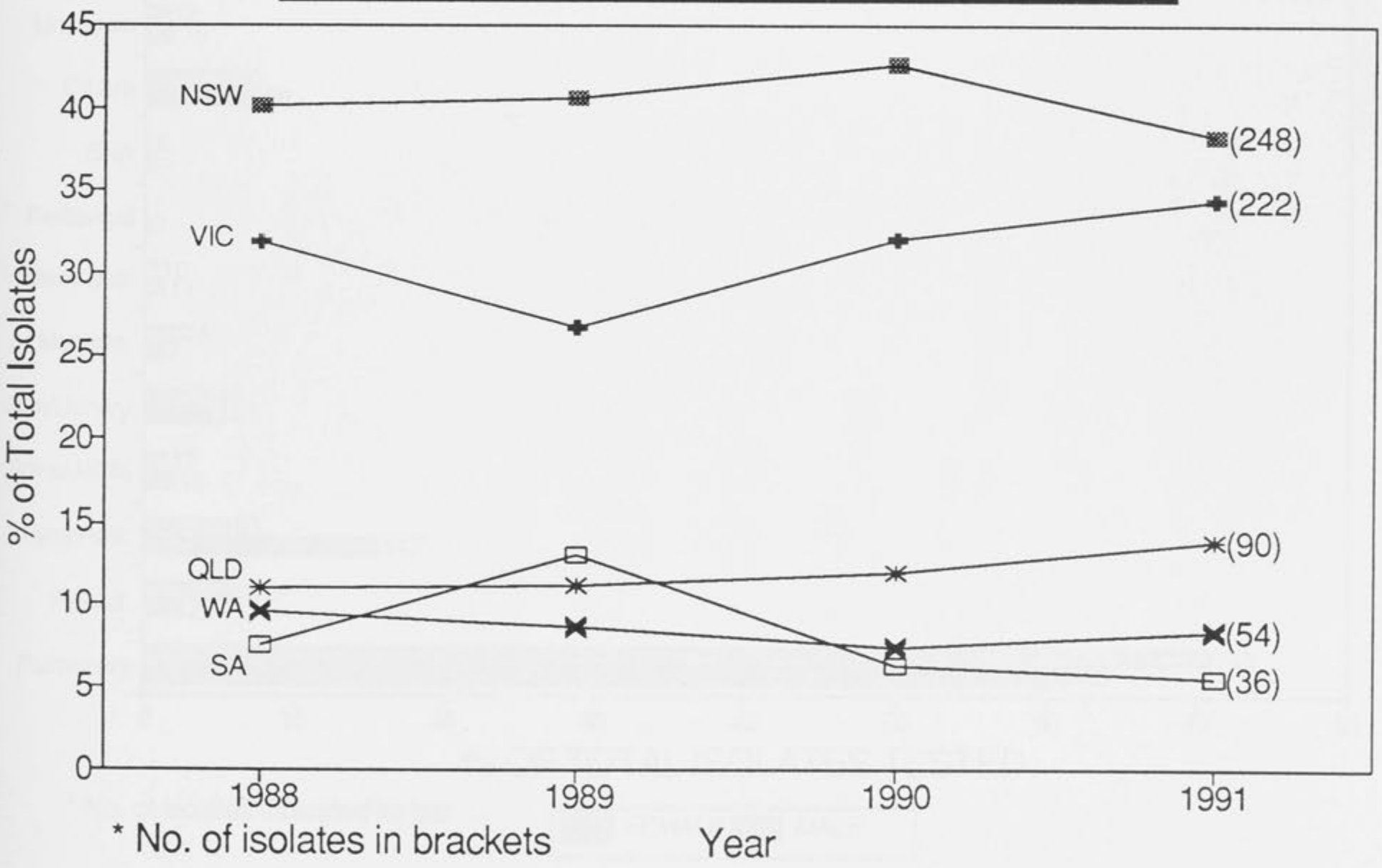
Australian Tuberculosis Reporting Scheme
Mycobacterium tuberculosis Complex

Contributing Laboratories :

Mycobacteriology Laboratory, Westmead Hospital, NSW.
Mycobacterium Reference Laboratory, Fairfield Hospital, VIC.
Mycobacterial Reference Laboratories, IMVS, SA.
TB Laboratory, State Health Laboratory, QLD.
Mycobacteria Laboratory, State Health Lab. Services, WA.

M Tb cases tested in Australian Reference Laboratories, 1988 - 1991

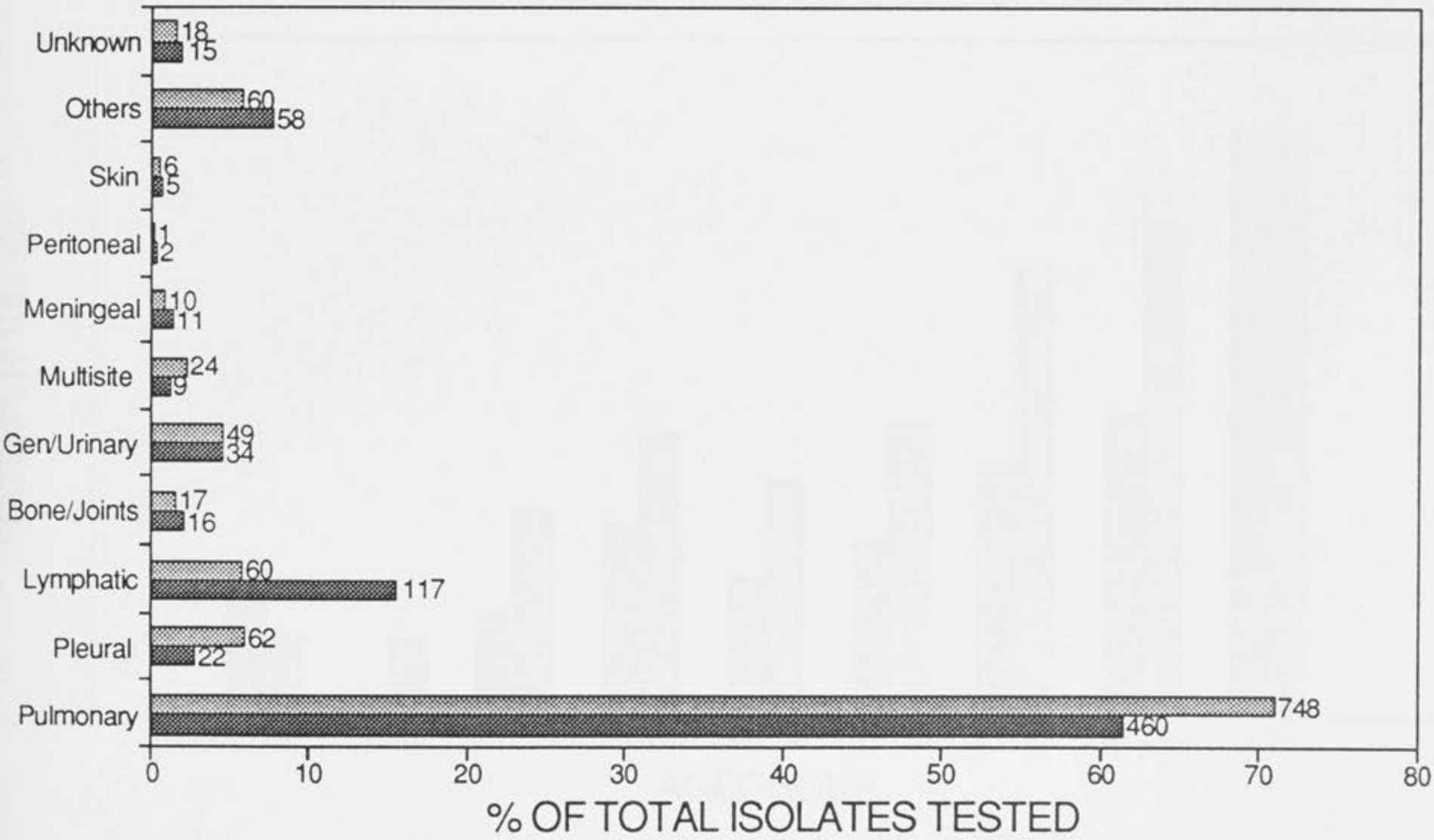
Percentage of Total Isolates Tested by Lab and Year



* No. of isolates in brackets

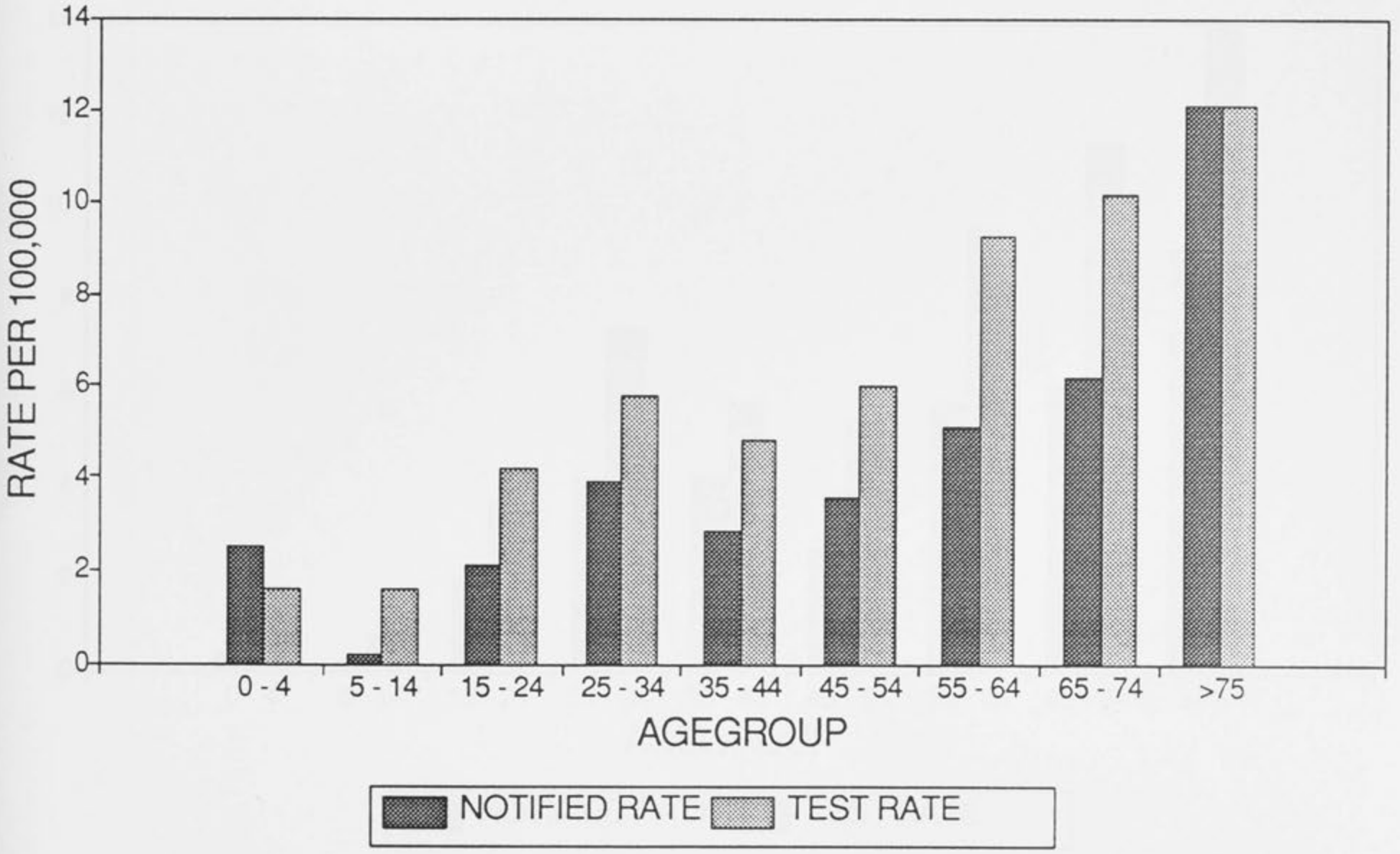
M Tb cases tested in Australian Reference Laboratories 1989 - 1991

Sites of isolates and Sex of cases



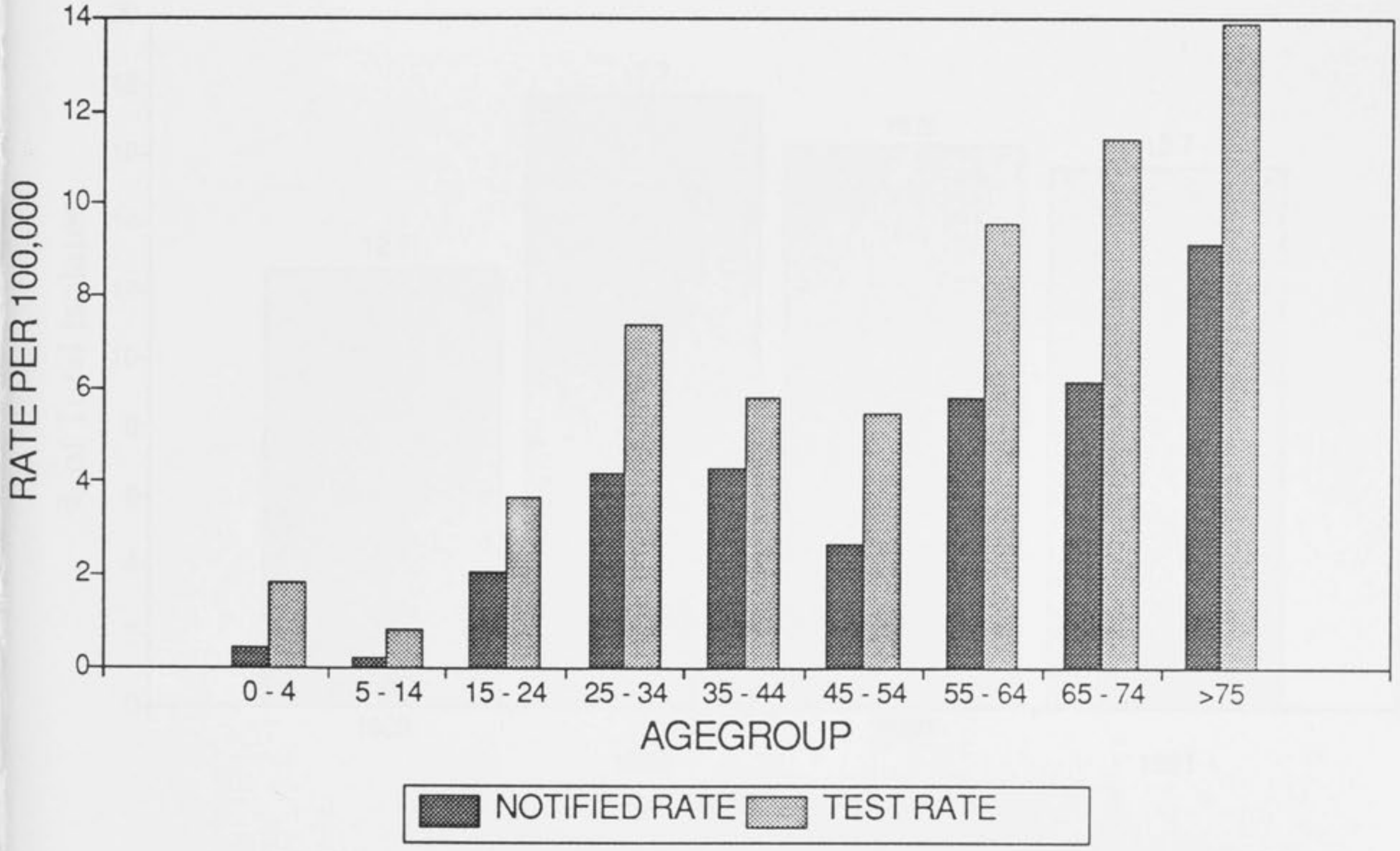
M Tb cases tested in Australian Reference Laboratories, 1989

Comparison of Agegroup Specific Rates with Notified Rates



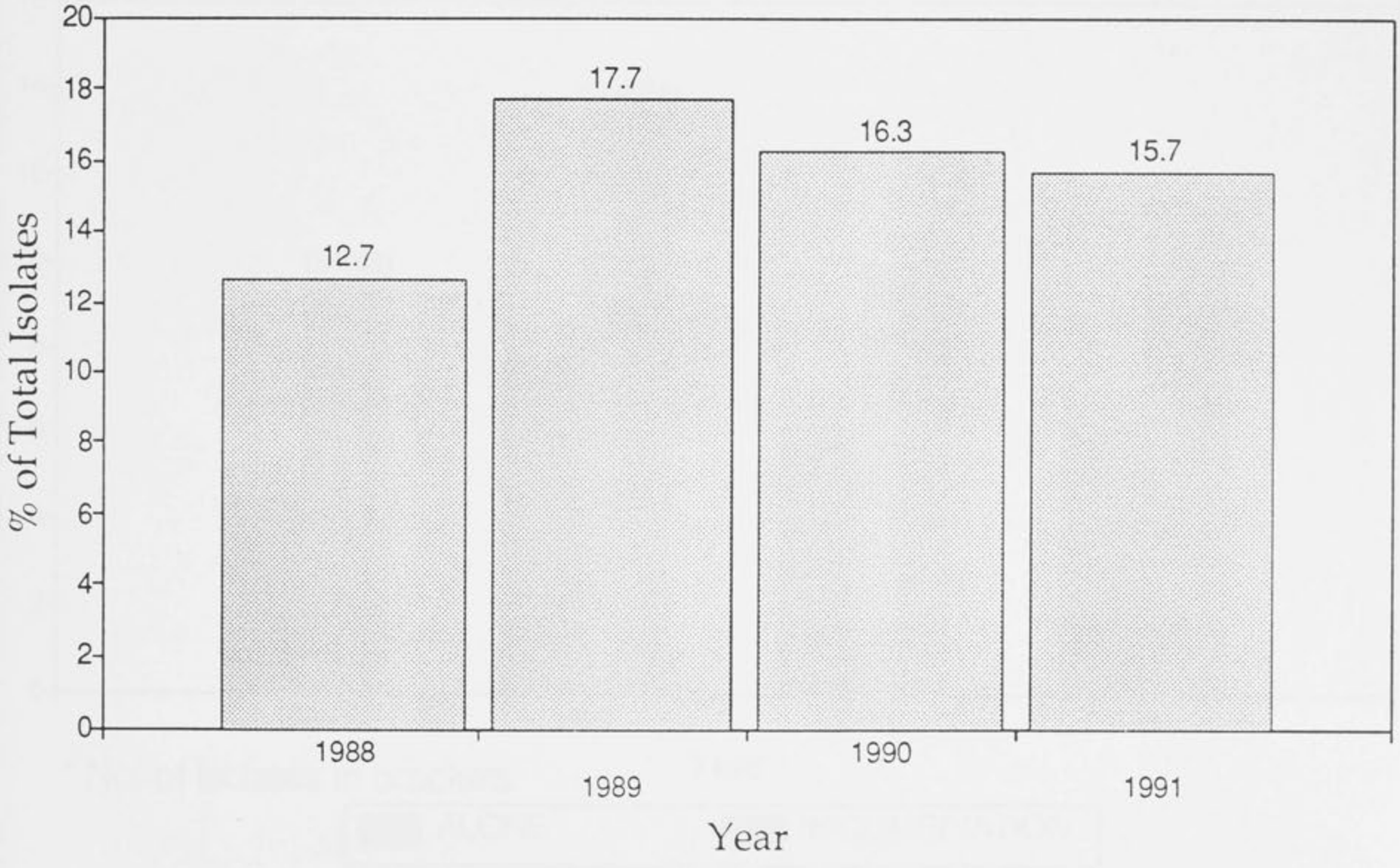
M Tb cases tested in Australian Reference Laboratories, 1990

Comparison of Agegroup Specific Rates with Notified Rates



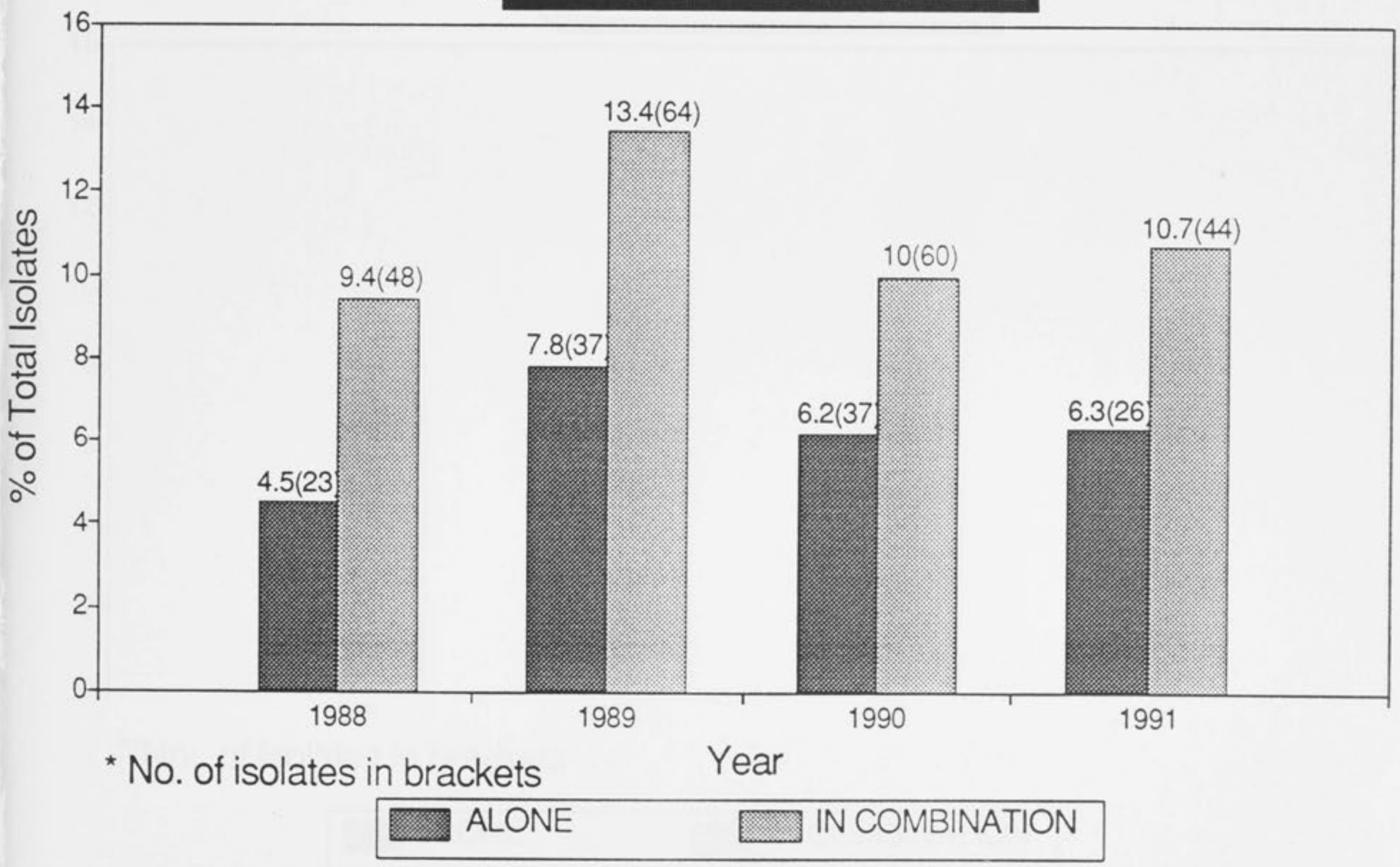
M Tb cases isolated in Australian Reference Laboratories, 1988 - 1991

Percentage of total isolates showing resistance



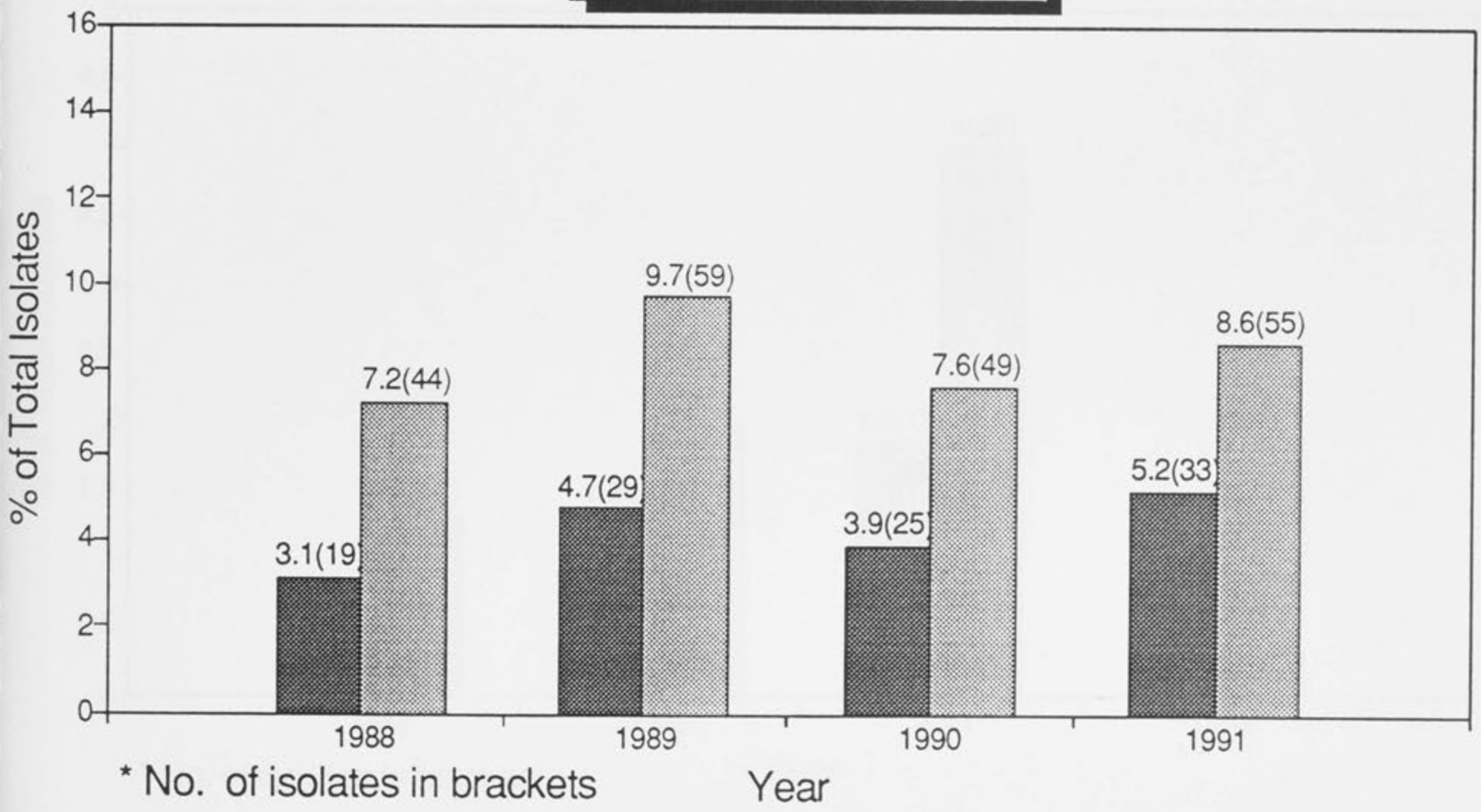
M Tb cases tested in Australian Reference Laboratories, 1988 - 1991

STREPTOMYCIN RESISTANCE



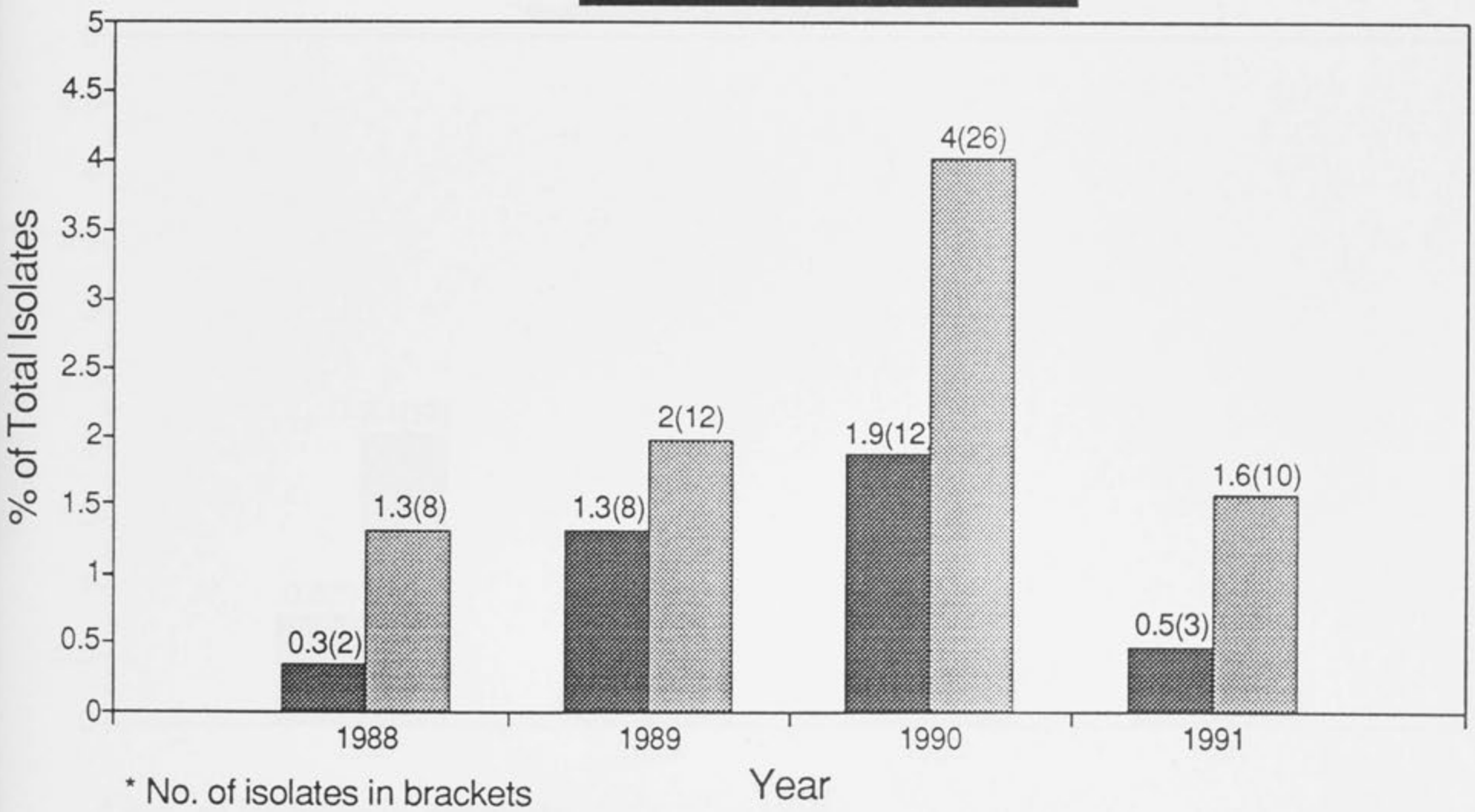
M Tb cases tested in Australian Reference Laboratories, 1988 - 1991

ISONIAZID RESISTANCE

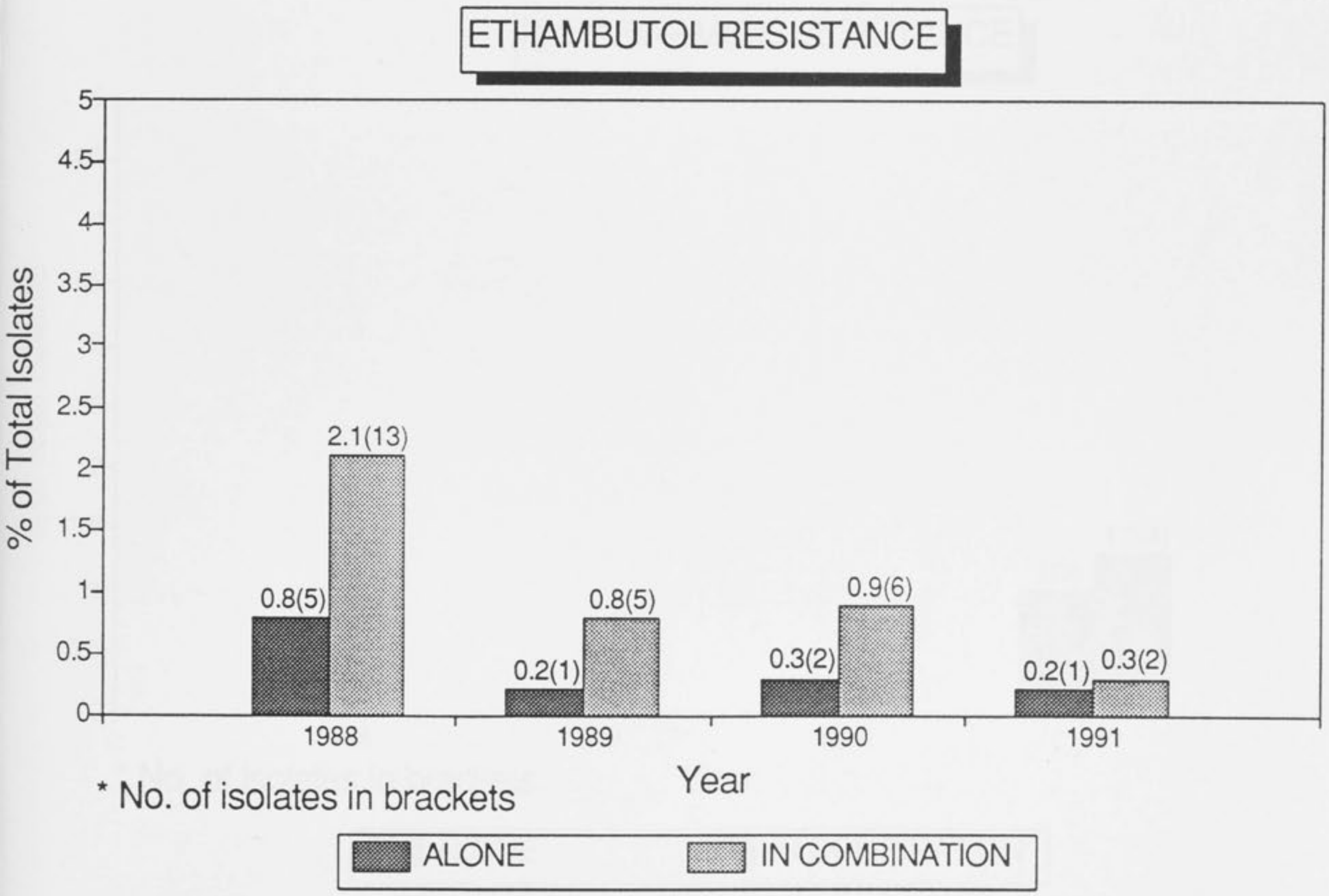


M Tb cases tested in Australian Reference Laboratories, 1988 - 1991

RIFAMPICIN RESISTANCE

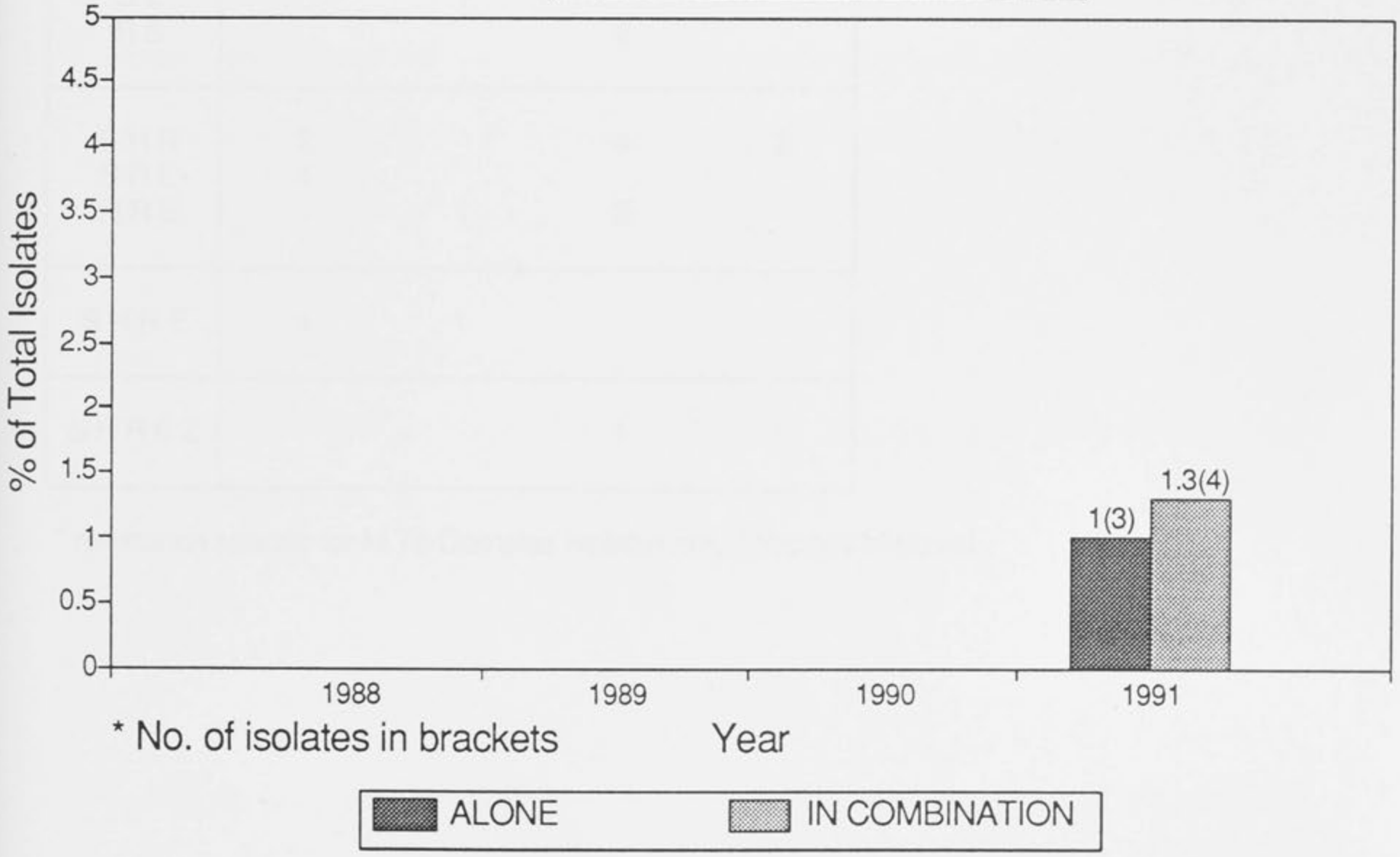


M Tb cases tested in Australian Reference Laboratories, 1988 - 1991



M Tb cases tested in Australian Reference Laboratories, 1988 - 1991

PYRAZINAMIDE RESISTANCE



M Tb cases tested in Australian Reference Laboratories, 1988 - 1991

Drug Resistance Combinations

Drug	1988 n=613 r=78	1989 n=610 r=108	1990 n=646 r=105	1991 n=650 r=102
S H H R H E S E R S	15	23 2 1 1	14 3 2	15 4
S H R S H E H R E	2 4	 1	4 2	2
S H R E	4	1		
S H R E Z		1		1

* resistance specific for M Tb Complex isolates only (includes M Bovis)

Measles Vaccination Efficacy in a Canberra High School

A Study conducted following a measles outbreak

Slide 1 - Title

"Measles vaccination efficacy in a Canberra High School. A study conducted following a measles outbreak." An outbreak of measles occurred in Canberra between October 1991 and January 1992, involving both primary and high school children and within the northern and southern suburbs of Canberra. The vaccine efficacy study commenced in late February, following the commencement of the new school year, in the high school which had the most cases documented in the outbreak.

Slide 2 - Acknowledgments

I wish to acknowledge the following people and organisations. Without their help and advice, this study would not have been possible.

(3 Clinical Slides)

During the outbreak of 1991 and 1992, 82 cases of measles were detected by case finding alone. This was based on school reports, general practitioner notifications and tracing through cases and contacts. The cases had to fulfil the clinical case definition, derived from the Canadian Diseases Weekly Record.

Slide 3 - Case definition

These are :

- a high fever, greater than 38.3 degrees Centigrade,
- cough, coryza or conjunctivitis, followed by
- a generalised maculopapular rash lasting for at least 3 days.

For this outbreak, cases must have a rash and one other feature, be identified by their GPs, school or by case finding and must occur between the months of September and December, 1991. Confirmed cases must have serological confirmation. In this outbreak, 22% or 18 cases had serological confirmation.

Slide 4 - Outbreak curve

The outbreak curve shows that 8 cases occurred in October, 50 in November and 24 in December alone. The number of cases peaked in late November and early December and declined over December. The annual school holidays in December resulted in a halt to the natural progression of the disease. Sporadic cases continued to be notified in January, with 7 reported. The outbreak curve shows approximated 4 generations of transmission. We suspected that the index case was infected through a school camp. This outbreak also highlighted the problems of notification of measles by doctors as only 6 cases were notified in November.

Slide 5 - Cases by age group and sex.

The first few cases occurred in a primary school and later spreading to high schools, presumably through family clusters. High school children accounted for 84% of all cases. Females predominate in the 10 to 14 year age group while

males predominate in the 15 to 19 year old age group. Overall, males accounted for 56 % of cases. 30% of cases occurred in primary school children and 59% occurred in high school children. A small number of cases were from pre school children. There were 15 family clusters in the outbreak resulting in 39 cases and 4 of these families had serological confirmation. The high school which had the most number of cases was chosen for the measles vaccine efficacy study. This study was planned and negotiated over the school holidays and operationalised when the school return for the new year in 1992.

Slide 6 - Objectives

The purposes of the study were to

- to measure the measles vaccine coverage for these children.
- assess the measles vaccine efficacy for Grade 8, 9 and 10.
- to determine attack rates in the partially immunised population.

Slide 7 - Methods

1 All children in Grade 8, 9 and 10 were surveyed using a standardised questionnaire. We selected these grades because they had the most number of cases during the outbreak. Grade 7 was not selected because the children came from different primary schools and we were not convinced of exposure status.

2 Non respondents were identified from class registers and followed up by telephone. 29 students were excluded from the study because they were new to the school and were therefore not considered exposed or had left

school and were not traceable. One student refused to participate in the survey. One case was excluded because he developed the disease in May, well out of the outbreak time frame.

3 Parents were asked to view immunisation records of their children before completing the questionnaire, wherever possible, to minimise recall bias. Records were also checked with the ACT Board of Health immunisation database, if the immunisation histories were questionable. All cases must have their immunisation history documented by viewing records.

4 A standardised case definition was used to classify potential cases. The same case definition for the outbreak was used. Most of the cases were previously identified in the outbreak and we took this opportunity to document missed cases. This enabled and accurate calculation of attack rates for the Grades involved.

Slide 8 - Attack Rates and vaccine coverage.

This slide shows that the highest attack rate occurred in Grade 10, which was consistent with the grade with the highest number of cases reported in the outbreak. We noted that 12 cases were missed by case finding last year. The vaccine coverage decreases from 85.5% in Grade 8 to 79.2% in Grade 10.

Slide 9 - Vaccine efficacy formula

We calculated the vaccine efficacy using the following formula. Vaccine efficacy, in percent is the attack rate in the unvaccinated, minus the attack rate in the vaccinated, divided by the attack rate of the unvaccinated, multiply by 100 . Dividing the numerator with the attack rate of the unvaccinated results in the analogous formula, 1 minus the relative risk. This is the ratio of the incidence of the vaccinated to the unvaccinated.

Slide 10 - Results from Epi Info.

This is the results as presented to us by Epi Info. 19 cases out of the 32 were vaccinated. We had 16 students who did not know their vaccination status, who had no records and were not verifiable by any other means. These are mostly students who were transferred in from interstate or overseas and have lost their records. This presents us with a problem of what to do with this group of individuals, in analysing the data for vaccine efficacy. We decided to do this 4 different ways to compare the results. The next 4 slides represent a sensitivity analysis depending on how these cases were handled.

Slide 11 - Vaccine efficacy results (1)

1 First we arbitrarily assigned them to the vaccination group. This would increase the denominators for the vaccinated group, resulting in decreasing the attack rate of the vaccinated and enhancing the vaccine efficacy. This shows a relative risk of 0.27 and a vaccine efficacy of 73 %.

Slide 12 - Vaccine efficacy results (2)

2 Second we assigned the unknowns to the unvaccinated group. This would increase the denominators for the unvaccinated group, resulting in decreasing attack rate of the unvaccinated, resulting in a increased relative risk but decreased vaccine efficacy. The relative risk calculated is 0.33 and the vaccine efficacy is calculated as 67%.

* However, when divided by the attack rate of the vaccinated, this would result in a larger relative risk and a smaller vaccine efficacy.

Slide 13 - Vaccine efficacy results (3)

3 Third we discarded the unknowns, and analysed only the known vaccinated status. This shows a relative risk of 0.28 and a vaccine efficacy of 72%.

Slide 14 - Vaccine efficacy results (4)

4 Lastly, we arbritarily assigned the 16 unknowns into the proportion of vaccinated and unvaccinated in the school cohort. that is, 3 as not vaccinated (15% of the group) and 13 as vaccinated (82% of the group). The vaccine efficacy turns out to be 72%.

So, in summary, the vaccine efficacy varies from, at worst, 67% and at best, 73% depending on how you deal with the unknowns. This figure is similar to a recent New Zealand study which shows a vaccine efficacy of 69% for the 10 to 19 age group, in a study following their outbreak of measles. This outbreak gave us an ideal opportunity to study the vaccine efficacy in the Australian setting.

Slide 15 - Possible explanations

This slide shows some of the possible explanations for a low vaccine efficacy.

1 poor vaccine storage or method of administration is a possibility. A recent study published in the New Zealand shows that up to 90% of fridges used in vaccine storage by general practices operated outside the recommended temperatures of 2 to 8 degrees Centigrade, for storage of vaccines. Improper storage of the vaccine may cause it to be ineffective.

2 another possibility is a biased ascertainment of the vaccination status in our study. This results from recall bias when more cases were recorded as vaccinated when in fact they are not. We have tried to minimised that by insisting on viewing records by the cases.

3 waning immunity from primary vaccination without continual challenge by wild virus is another possibility. We know that vaccination induces a lower antibody titre than the titre following natural infection. The degree to which these levels are reinforced by subsequent exposure to natural measles in the community is not known and waning immunity is feasible.

4 immunisation may have been performed in children under 12 months, leading to poor seroconversion because of circulating maternal antibody is another possible explanation. We were not able to identify the time of immunisation in this study, but it seems likely that in some instances, vaccination may have been performed in the wrong age group.

Slide 16 - Conclusions

The conclusions of the study are :

1 measles remains a serious public health problem in Canberra school children, with the age group specific attack rates shifted to high school children.

2 single vaccination in infancy may not provide durable immunity, because of the possibility of waning immunity due to lack of challenge from natural measles.

3 the newly adopted NHMRC policy of a two dose measles vaccination program is supported by this study, which shows a poor vaccine efficacy in high school children.

4 measles surveillance should be maintained with vigour, outbreak investigation and disease control measures instigated promptly wherever possible. Age specific vaccine efficacy should be monitored.

5 Lastly, a good vaccine coverage alone may not be sufficient to ensure elimination of measles, without the monitoring of vaccine efficacy and immunity studies from vaccination.

Slide 1

Measles Vaccine Efficacy in a Canberra High School, 1991-1992.

A study conducted following a measles outbreak

by

David Cheah

Communicable Diseaes Section

Slide 2

Acknowledgments :

Dr Robert Scott, Chief Health Officer, ACT.

Ms Irene Passaris, Communicable & Environmental Disease Control Branch, ACT Board of Health.

Mr Ray Gunn, Principal, Lyneham High School, Canberra.

Dr J. Michael Lane, WHO Consultant, NCEPH.

Dr Aileen Plant, NCEPH.

Dr Robert Hall, Director, Communicable Diseases Section, DHH,CS.

Slide 3

Case definition

Clinical :

(1) Fever > = 38.3°C (101°F)

(2) Cough, coryza or conjunctivitis followed by,

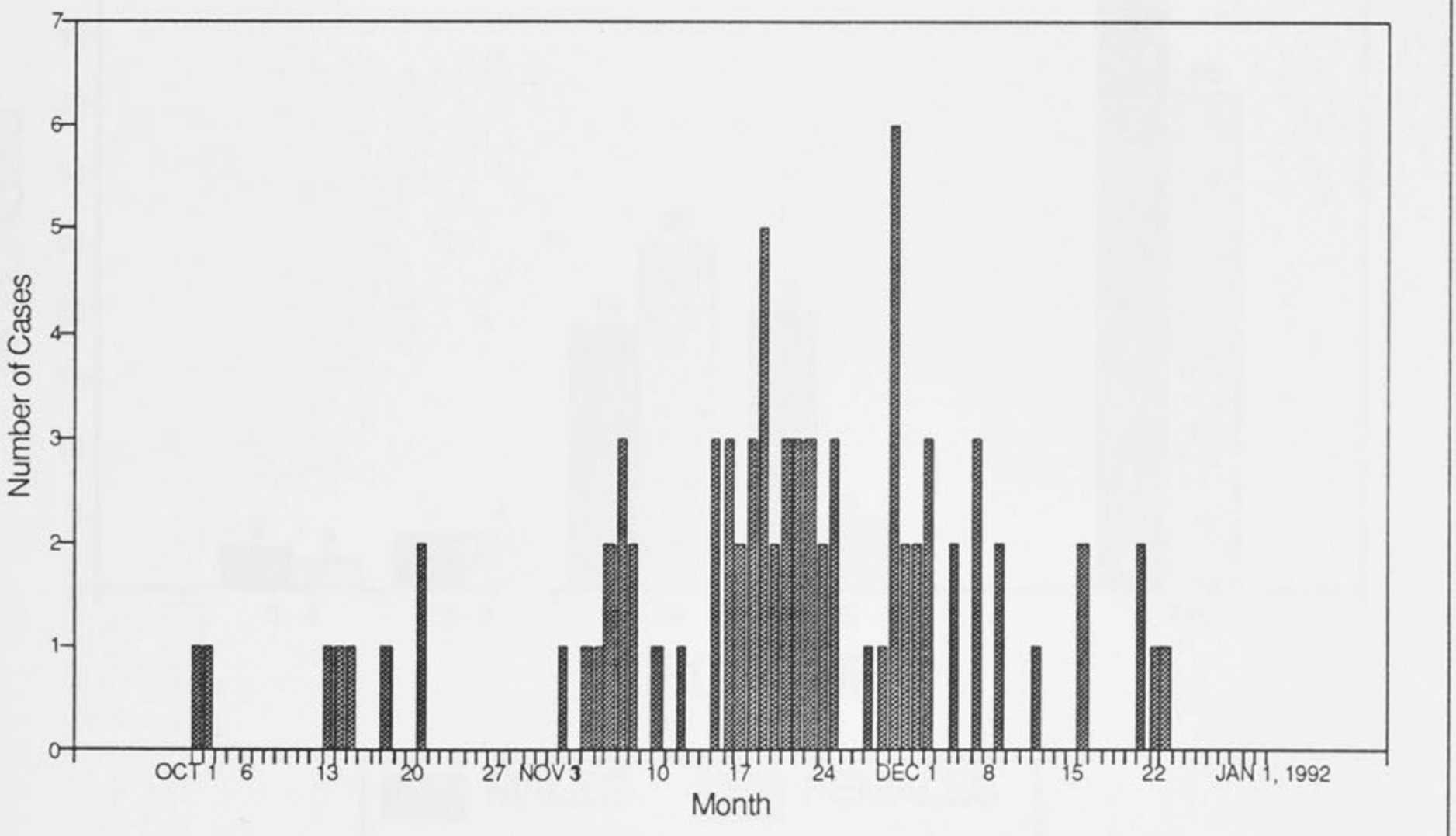
(3) Generalised maculopapular rash for at least 3 days.

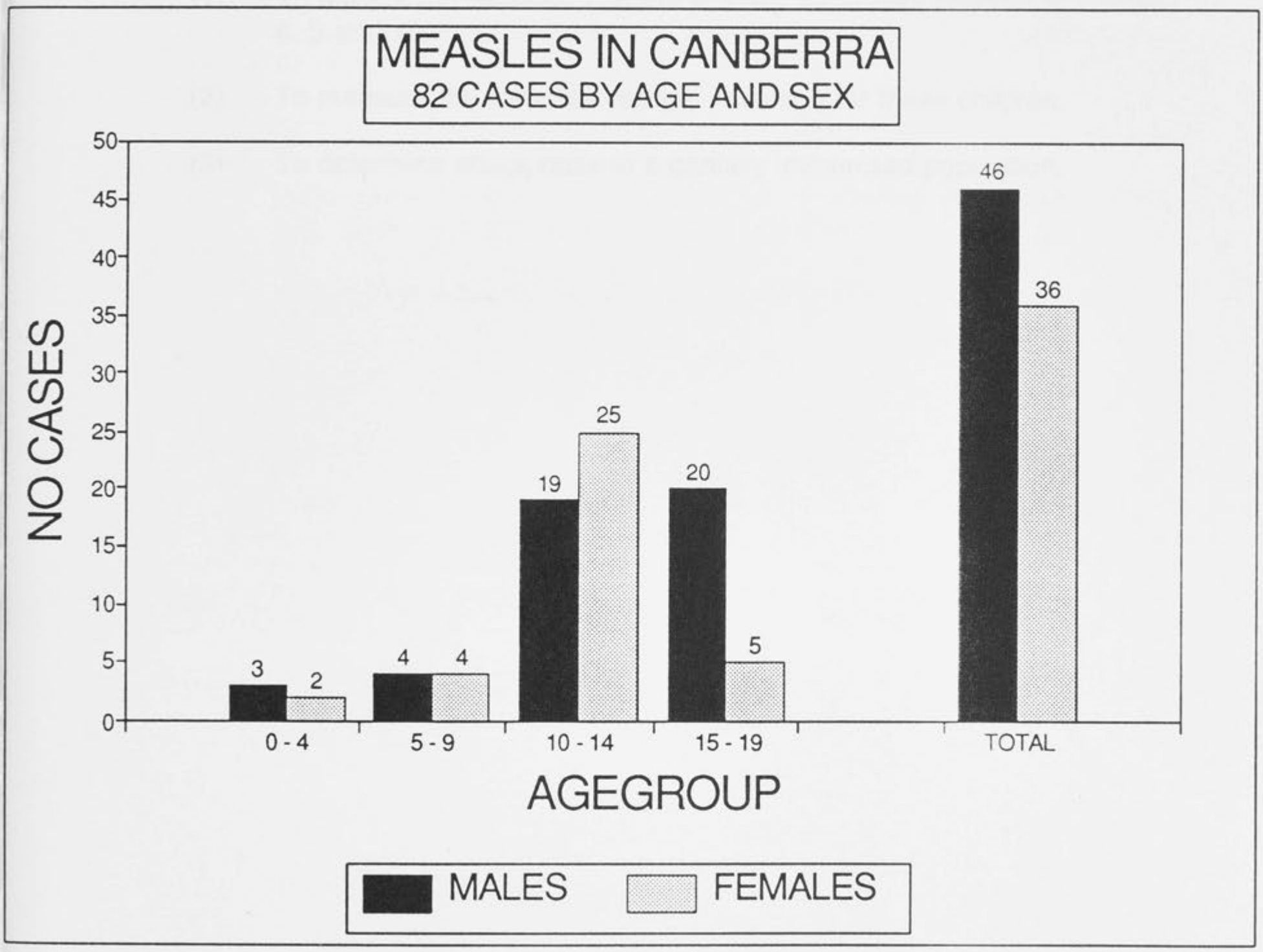
Confirmed cases must have positive serology (a 4 fold rise in measles specific IgM)

Reference : Disease Specific Case Definitions and Surveillance Methods. Canada Diseases Weekly Report 1991;17S3:23

MEASLES OUTBREAK, CANBERRA, OCT. - DEC., 1991

82 Cases by Date of Onset of Symptoms




MEASLES IN CANBERRA
82 CASES BY AGE AND SEX
NO CASES
50
45
40
35
30
25
20
15
10
5
0
3
2
4
4
19
25
20
5
46
36
0 - 4
5 - 9
10 - 14
15 - 19
TOTAL
AGEGROUP
MALES
FEMALES

Slide 6

Objectives :

(1) To assess the measles vaccine efficacy for school children in Grades 8, 9 and 10.

(2) To measure the measles vaccine coverage for these children.

(3) To determine attack rates in a partially immunised population.

Slide 7

Methods :

(1) All children in Grade 8, 9 and 10 were surveyed using a standardised questionnaire.

(2) Non respondents were identified from class registers and followed up.

(3) Immunisation histories were validated by viewing individual records and health centre records wherever possible.

(4) A standardised case definition was used to classify potential cases.

Slide 8

Attack Rate and Vaccine Coverage by Grade in a Canberra High School.
October 1991 to January 1992.

Grade	No. Cases	School Census	Vaccine coverage(%	Attack Rate/1000
8	11	179	85.5	61.5
9	11	201	82.6	54.7
10	13	197	79.2	66
	35	577	82.3	60.7

* Attack Rate per 1000
* Vaccine coverage in %

Slide 9

Vaccine Efficacy was calculated using the formula :

$$\textbf{Vaccine Efficacy \%} = \frac{\textbf{AR (u) - AR(v)}}{\textbf{AR (u)}} \textbf{ X 100}$$

Where :

* Ar (u) = Attack Rate in the Unvaccinated.
* AR (v) = Attack Rate in the Vaccinated.

* This formula can also be written as :

Vaccine Efficacy = (1 - Relative Risk) X 100

Slide 10

Vaccination Status	Measles: Yes	Measles: No	Total
Yes	19	417	436
No	13	70	83
Unknown	0	16	16
Total	32	503	

Slide 11

Measles Vaccine Efficacy in a High School, Canberra, ACT, 1992.
For the 13 to 15 Year Age Group

		Measles: Yes	Measles: No	Total
Vaccination Status	Yes	19	433	452
	No	13	70	83
		32	503	535

* 16 students with Unknown Vaccination Status
were arbitrarily assigned to the Vaccinated group.

RELATIVE RISK = 0.27 (95% C.I., 0.14 < RR < 0.52)

VACCINE EFFICACY = 73 %

Slide 12

Measles Vaccine Efficacy in a High School, Canberra, ACT, 1992.
For the 13 to 15 Year Age Group

		Measles: Yes	Measles: No	Total
Vaccination Status	Yes	19	417	436
	No	13	86	99
		32	503	535

* 16 students with Unknown Vaccination Status
were arbitrarily assigned to the Unvaccinated group.

RELATIVE RISK = 0.33 (95% C.I., 0.17 < RR < 0.65)

VACCINE EFFICACY = 67 %

Slide 13

Measles Vaccine Efficacy in a High School, Canberra, ACT, 1992.
For the 13 to 15 Year Age Group

		Measles: Yes	Measles: No	Total
Vaccination Status	Yes	19	417	436
	No	13	70	83
		32	487	519

* 16 students with Unknown Vaccination Status were arbitrarily discarded from analysis.

RELATIVE RISK = 0.28 (95% C.I., 0.14 < RR < 0.54)

VACCINE EFFICACY = 72 %

Slide 14

Measles Vaccine Efficacy in a High School, Canberra, ACT, 1992.
For the 13 to 15 Year Age Group

		Measles: Yes	Measles: No	Total
Vaccination Status	Yes	19	430	449
	No	13	73	86
		32	503	535

* 16 students with Unknown Vaccination Status
were assigned as 13 vaccinated and 3 unvaccinated
according to the proportion of the vaccination status in the group.

RELATIVE RISK = 0.28 (95% C.I., 0.14 < RR < 0.55)

VACCINE EFFICACY = 72 %

Slide 15

Possible explanations for the low vaccine efficacy observed during this outbreak include :

(1) poor vaccine storage or administration during the immunisation process.

(2) biased ascertainment of vaccination status due to recall bias.

(3) waning immunity from primary vaccination without continual challenge by wild virus.

(4) immunisation may have been performed in children under 12 months at the time of vaccination, leading to poor seroconversion rates because of maternal antibody.

Slide 16

Conclusions :

(1) Measles remains a serious public health problem for Australian school children.

(2) Single vaccination in infancy may not provide durable immunity lasting into the high school years.

(3) This study supports the newly adopted NHMRC policy of booster immunisation at school entry.

(4) Measles surveillance should be strengthened, outbreaks investigated, control protocols should be available and implemented and age specific vaccine efficacy monitored.

Tuberculosis in Australia, 1986 - 1991.

An Analysis of Notification Data

by David Cheah & Robert Hall

Slide 1 - Title

The title of this talk is **"Tuberculosis in Australia, 1986 to 1991 - An Analysis of Notification Data."** We are both from the Communicable Diseases Section of the Commonwealth Department of Health, Housing and Community Services. The Communicable Diseases Section has a major role in the surveillance of notifiable diseases in Australia and the unit publishes the Communicable Diseases Intelligence on a fortnightly basis.

Slide 2 - Acknowledgments

I would like to acknowledge the contribution made by the following people within the different State and Territory Health Departments. Their data made this analysis possible.

Added to this list should be Drs Mike Lane and Dr Aileen Plant of NCEPH.

Slide 3 - Tb Rates, 1948 to 1990

This graph shows the rate of tuberculosis, which includes "atypical" Tb, since 1948. It shows the impact of the Tb campaign which was launched after the second world war. The downward trend is followed by a flattening since the early 80's. There is an apparent upward trend since 1988. This upward trend is misleading because the rate described here is the rate for all forms of tb, which

consisted of new cases plus "atypical" cases of Tb. To be accurate one needs to take out the "atypical" cases as this may artificially inflate the true rate of the new cases. There was therefore a pressing need to identify the rate of new cases since 1985.

Slide 4 - Case definition

Tuberculosis or Tb as it is often known is caused by the Mycobacterium tuberculosis complex. We commonly think of Tb as a highly contagious infection which affects the lungs. We defined a new case of Tb as :

* a case which has been confirmed by the identification of the organism by culture or microscopy OR
* a case of tuberculosis which has been diagnosed to be active, clinically and which has been accepted by the Director of Tb within the State or Territory. These cases have no bacteriological confirmation but have clinical symptoms which warrant treatment.

"Atypical" disease is caused by other Mycobacteria apart from Mycobacterium tuberculosis complex. They can affect many different parts of the body and are also now called "Non Tuberculous Mycobacteria". In this study, we will restrict our analysis to Mycobacterium tuberculosis, which is the most common form of Tb and M Bovis which is the bovine form of Tb.

The incidence is the rate of new cases per 100,000 population per year, based on the mid year population supplied by the Australian Bureau of Statistics.

Slide 5 - Objectives

The objectives of the study are :

1 To determine the incidence of tuberculosis in Australia between 1986 and 1991.

2 To identify the demographic characteristics of tuberculosis in this country.

3 To identify trends of the disease in foreign born Australians. We already know from the data from 1985, that a significant proportion of cases were from foreign born Australians, but the trend between 86 and 91 needs to be identified.

Our objectives of the study were necessary because data of Tb had not been available for many years and the last national analysis was done in 1985.

Slide 6 - Methods

We analysed data from 1986 to 1988 which had been previously collected but not analysed. We also sought from the States and Territories, data on Tb notification between 1988 and 1990, using a redesigned form based on the old surveillance system. This was commenced in mid 1991 and collection was completed later that year. In 1991, we also designed a new surveillance system, following and agreement by all States and Territories, under the auspices of the Communicable Diseases Network (Australia). This system is based on a record collection system instead of summary format of the previous system. Last year, all States and Territories contributed data using this format. Data from these three sources were then pooled together to provide rates for 1986 to 1991. This form of surveillance was to prove very effective when it came to analysis.

Slide 7 - Rate of new cases 1986 - 1991.

This graph shows the rate of new cases only, minus the "atypical" cases. It describes the true incidence of the diseases, given as the rate per 100,000, population per year. It shows that the rate is not increasing as it was once thought.

Slide 8 - Notification rates by State/Territories, 1991.

There were 903 new cases of Tb notified in Australia, a decrease of 9.1% in rate from the 1990 figure of 979 cases. This gives a rate of 5.2 per 100,000. This compares well with the United States figure of over 10 per 100,000. NSW has the highest proportion of cases, 42.9% of total, with ACT contributing the lowest number of cases. The largest decline in cases comes from the Northern Territory, with a decline of 52.1% change in rate, compared with the previous year. NSW and QLD were the only States which show increases in rate of new cases.

Slide 9 - Age Group Specific Rates of new cases, 1991.

Of the 903 new cases in 1991, 506 cases or 56% were males and 44% in females. Males have a greater rate of disease than females from the 35 year old age group onwards, with the greatest difference in the greater than 75 year old age group. From 55 year old onwards, males accounted for 64% of all cases.

Slide 10 - Site of disease of new cases, 1991.

This graph shows the site of disease of the cases. Pulmonary site accounted for 67.6% of all cases, with males predominating in pulmonary disease. Lymphatic site was the most common extrapulmonary site, accounting for 56% of all cases, with

females predominating in lymphatic disease. These findings confirm those of previous analysis by David Dawson, who looked at laboratory confirmed data only.

Slide 11 - Comparison of rates between foreign born & Australian born, 1986 - 1991.

This slide shows the different rates for Australian born and foreign born cases, from 1986 to 1991. The foreign born cases are nearly seven times the rate compared with Australian born cases. In 1991, 66% of total notified cases were foreign born compared with 34% Australian born. The percentage of foreign born cases in 1991 is also less than that in 1990, where 70.4% of total cases were foreign born. This graph also demonstrate a static trend for foreign born cases, with the rate in 1991, the lowest for six years.

Slide 12 - Age Group Specific Rates comparison between Australian born and foreign born.

This graph shows the age group specific rate of disease between foreign born and Australian born. (pause) You can see that the Australian born rates are fairly flat till the older age group while the foreign born rate of disease shows three peaks, one at under 5, one at the 20 to 24 year old age group and one at the 75 to 79 year old age group. This graph contrasts the natural progression of control of the disease from a high prevalent area to a low prevalent area like Australia.

Slide 13 - Length of Residence in Australia of foreign born cases, 1991.

This slide shows that 45% of foreign born cases of Tb get notified within 5 years of arrival in Australia and another 14% within the next five years. Only 22% of total cases were notified within the first 12 months of living in Australia.

Slide 14 - Conclusions

The conclusions of this study are :

1 The rate of new cases of tuberculosis in Australia have been stable since the mid 1980's.

2 The majority of cases of Tb in Australia occur in immigrants.

3 The age group specific rates are different between immigrants and Australians, with immigrants having higher rates in all ages, but with peaks of increase risk at the very young, the 20 to 24 age group and the greater than 75 year age group.

4 45% of cases of foreign born cases have their disease diagnosed within 5 years of arrival in Australia.

5 The surveillance of Tb needs to be continued to monitor future trends and to be further improved to look at other aspects of the disease

6 Further research needs to be done on Tb in immigrants, particularly the issue of relapse of disease following migration.

Slide 1

Tuberculosis in Australia, 1986 - 1991

Analysis of Notification Data

by

David Cheah & Robert Hall

Communicable Diseases Section

Slide 2

Acknowledgments :

Dr Michael Levy, NSW Health.

Dr Anil Patel, Patrick Derhy, Queensland Health.

Dr Jonathan Streeton, Melbourne.

Prue Morris, Health Department of Victoria.

Dr Jag Gill, Health Department of Western Australia.

Dr Ral Antic, Dr Andrew Thornton, South Australian Health Commission.

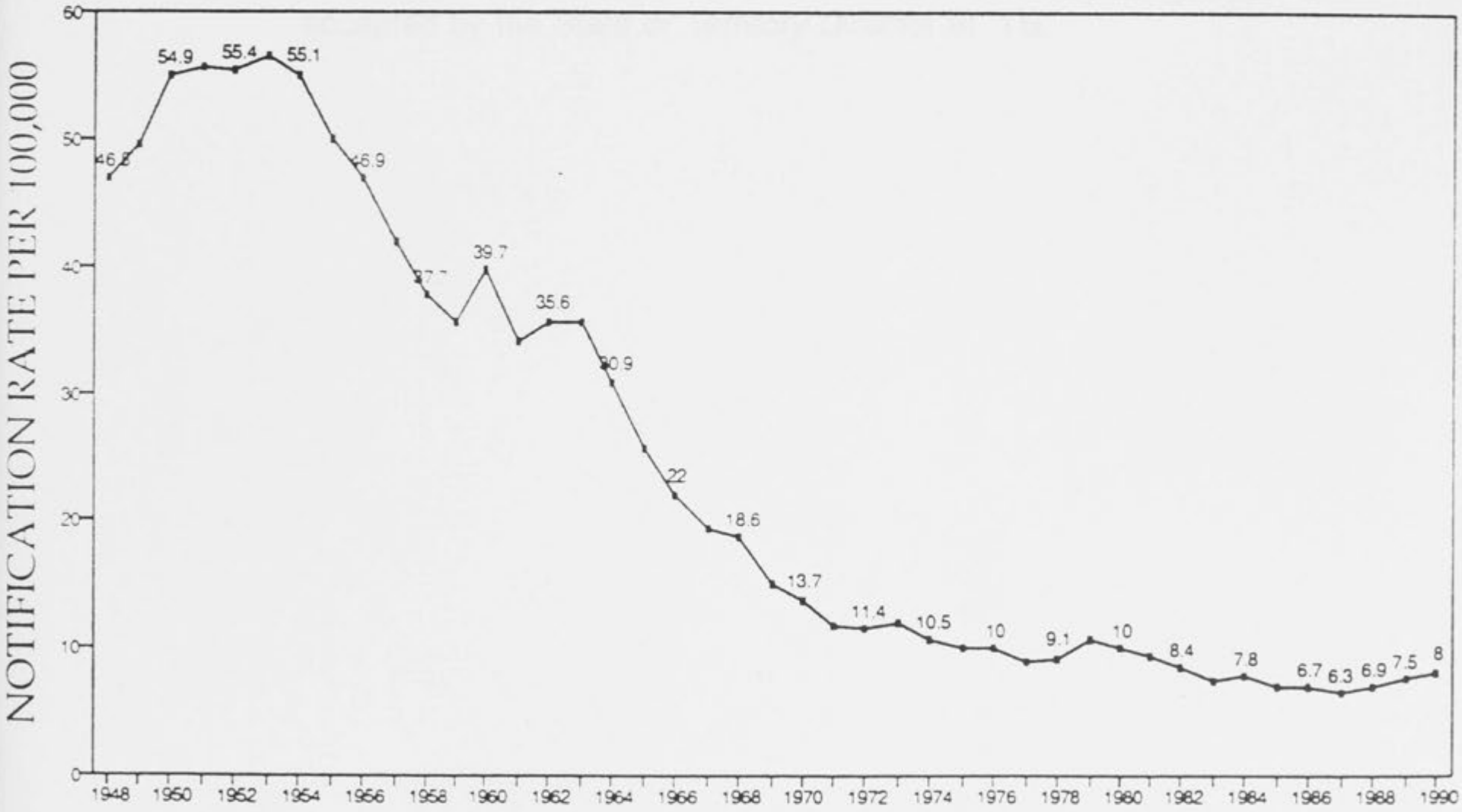
Dr Vicki Krause, Northern Territory Department of Health & Community Services.

Dr Robert Scott, Sr Elaine Collett, ACT Board of Health.

Dr A Misrachi, Dr Tony Watson, Department of Health, Tasmania.

Tuberculosis in Australia 1948 - 1990

Rate of notification for all forms (M Tb plus "Atypical" Disease)



* Rate per 100,000

Slide 4

Case definition

A new case of tuberculosis is :

1 A case which has been confirmed by the identification of ***Mycobacterium tuberculosis*** by culture or microscopy

2 A case of tuberculosis which has been clinically diagnosed and accepted by the State or Territory Director of TB.

Slide 5

Objectives :

(1) To determine the incidence of tuberculosis in Australia between 1986 and 1991.

(2) To identify the demographic characteristics of tuberculosis in this country including the country of birth.

Slide 6

Methods :

(1) We analysed data from 1986 to 1990.

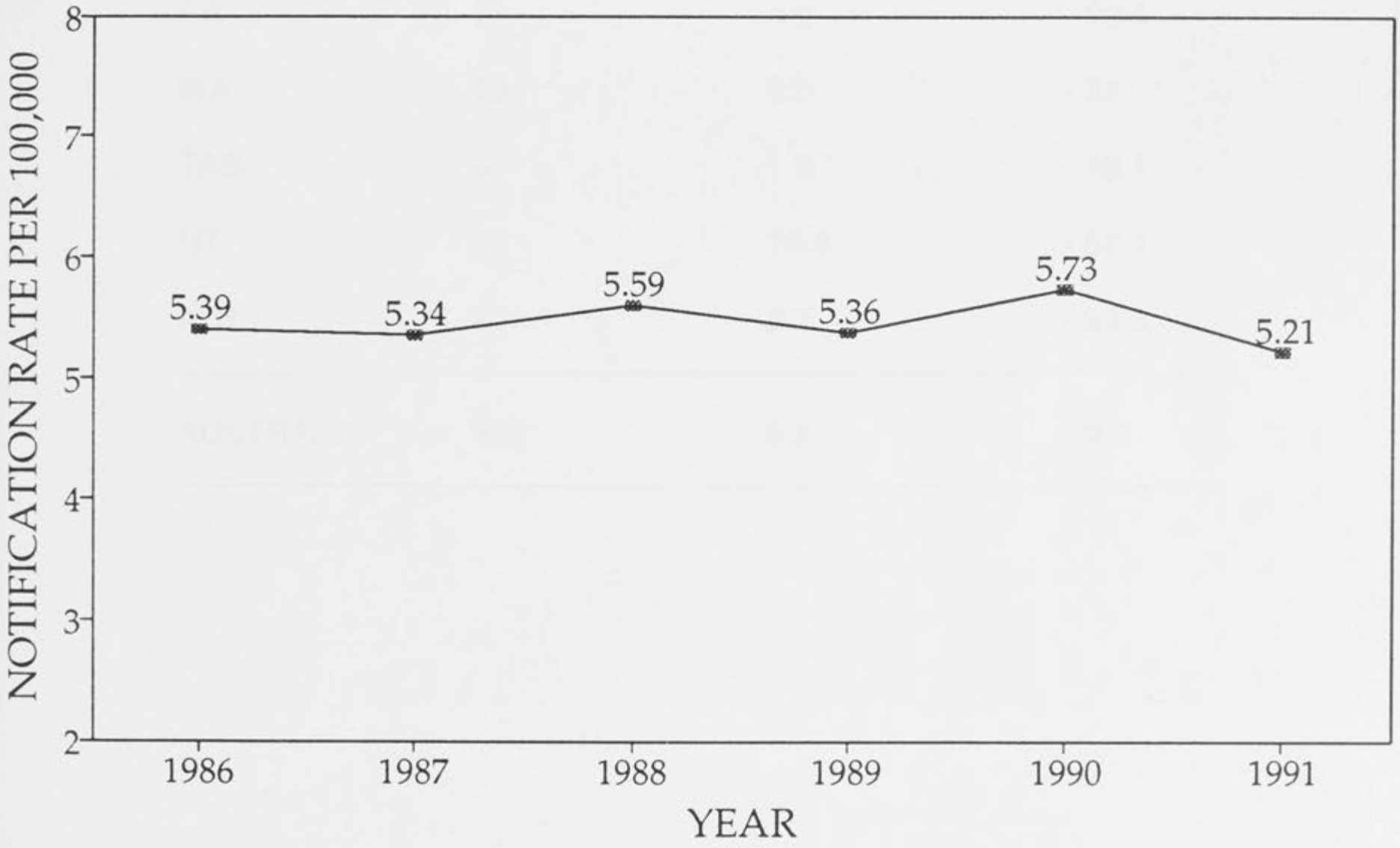
(2) We sought data on Tb notifications between 1988 to 1990 from the States and Territories, using the "old" surveillance system.

(3) We devised a new surveillance system. In 1991, all States and Territories contributed data to this system.

(4) The data from these three sources were pooled to obtain rates between 1986 and 1991.

Tuberculosis in Australia, 1986 - 1991

Rate of notified new cases per 100,000 per year.



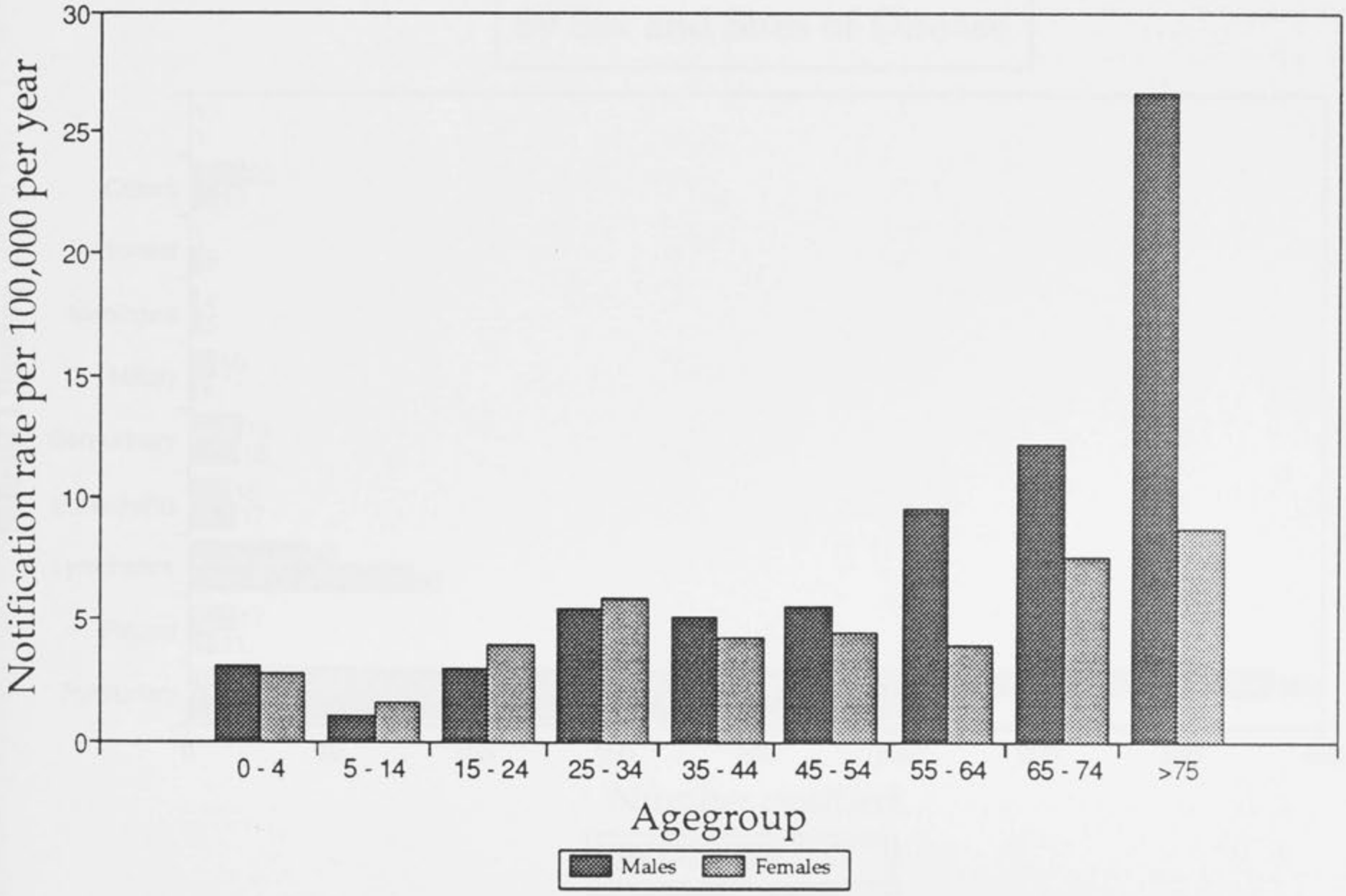
Notification rates for new cases of Tb.

By State and Territories, 1991.

State/ Territories	No Cases Notified	Rate/ 100,000/Yr	% Change in Rate from previous Yr.
NSW	388	6.6	+ 10.8
VIC	226	5.1	- 12.4
QLD	99	3.3	+ 4.1
SA	61	4.2	- 29.1
WA	83	5.0	- 31
TAS	9	1.9	- 19.1
NT	29	18.3	- 52.1
ACT	8	2.7	- 29.3
AUSTRALIA	903	5.2	- 9.1

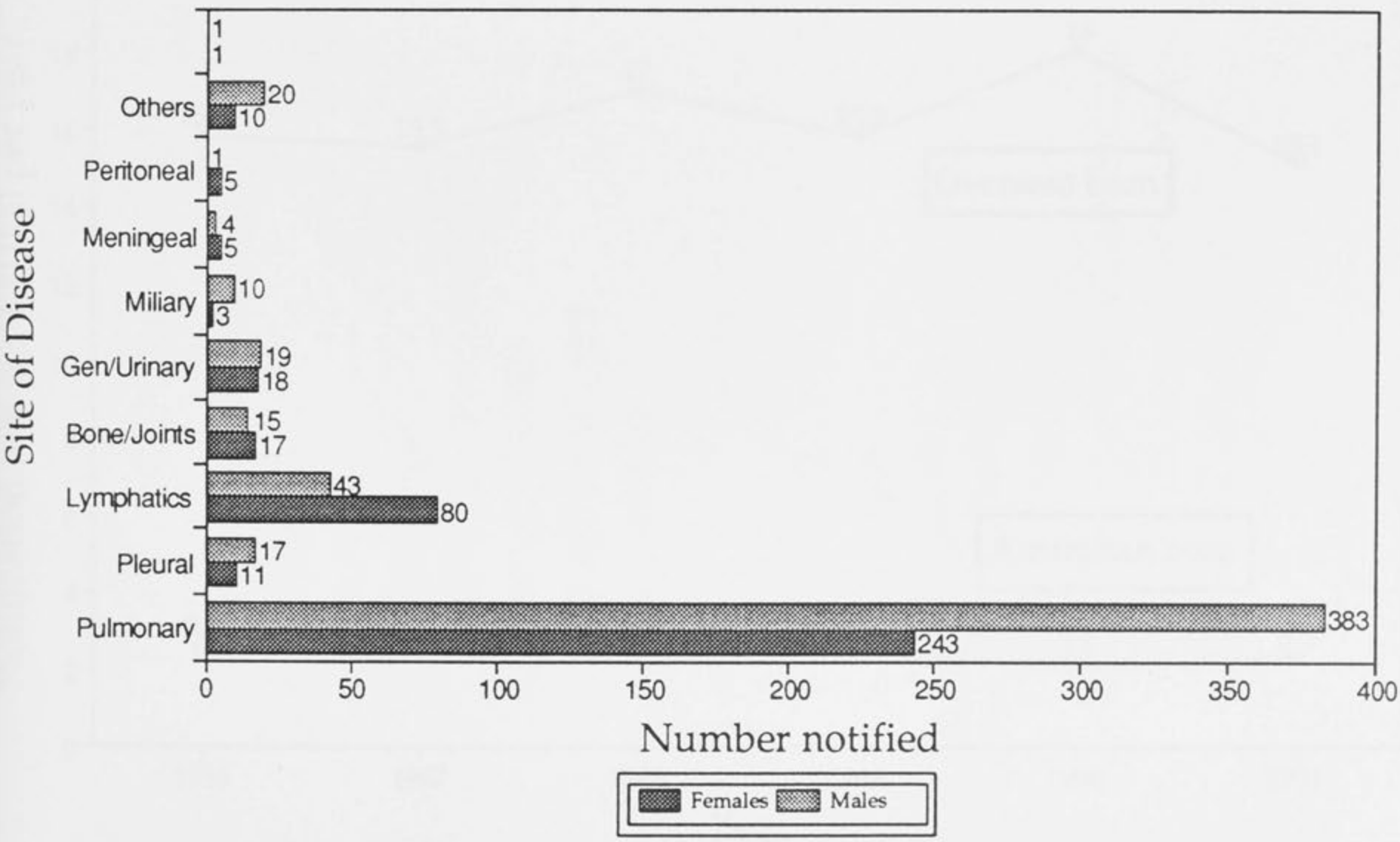
TUBERCULOSIS IN AUSTRALIA 1991

Sex and Age Group Specific Incidence



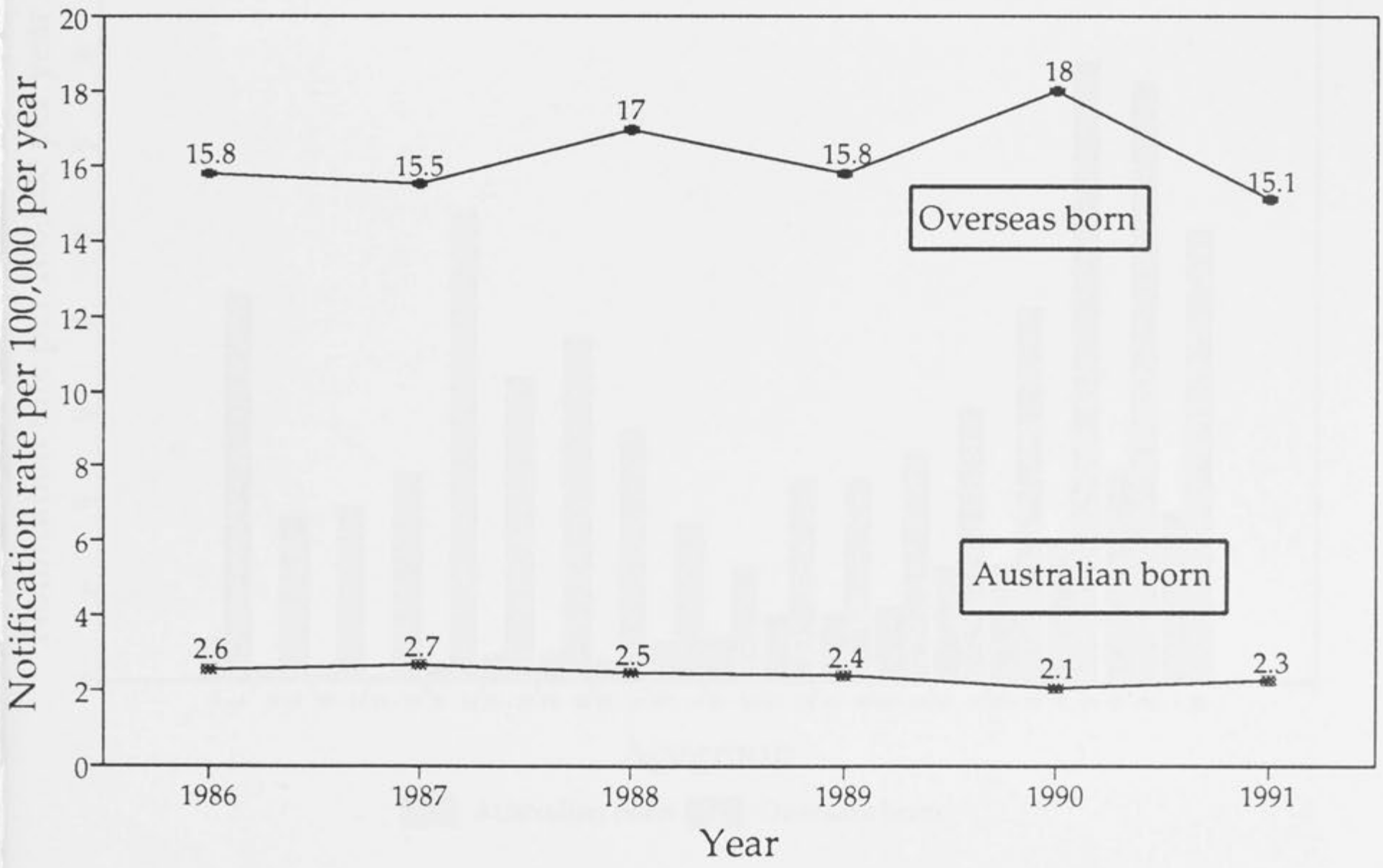
TUBERCULOSIS IN AUSTRALIA, 1991

By Sex and Sites of Disease

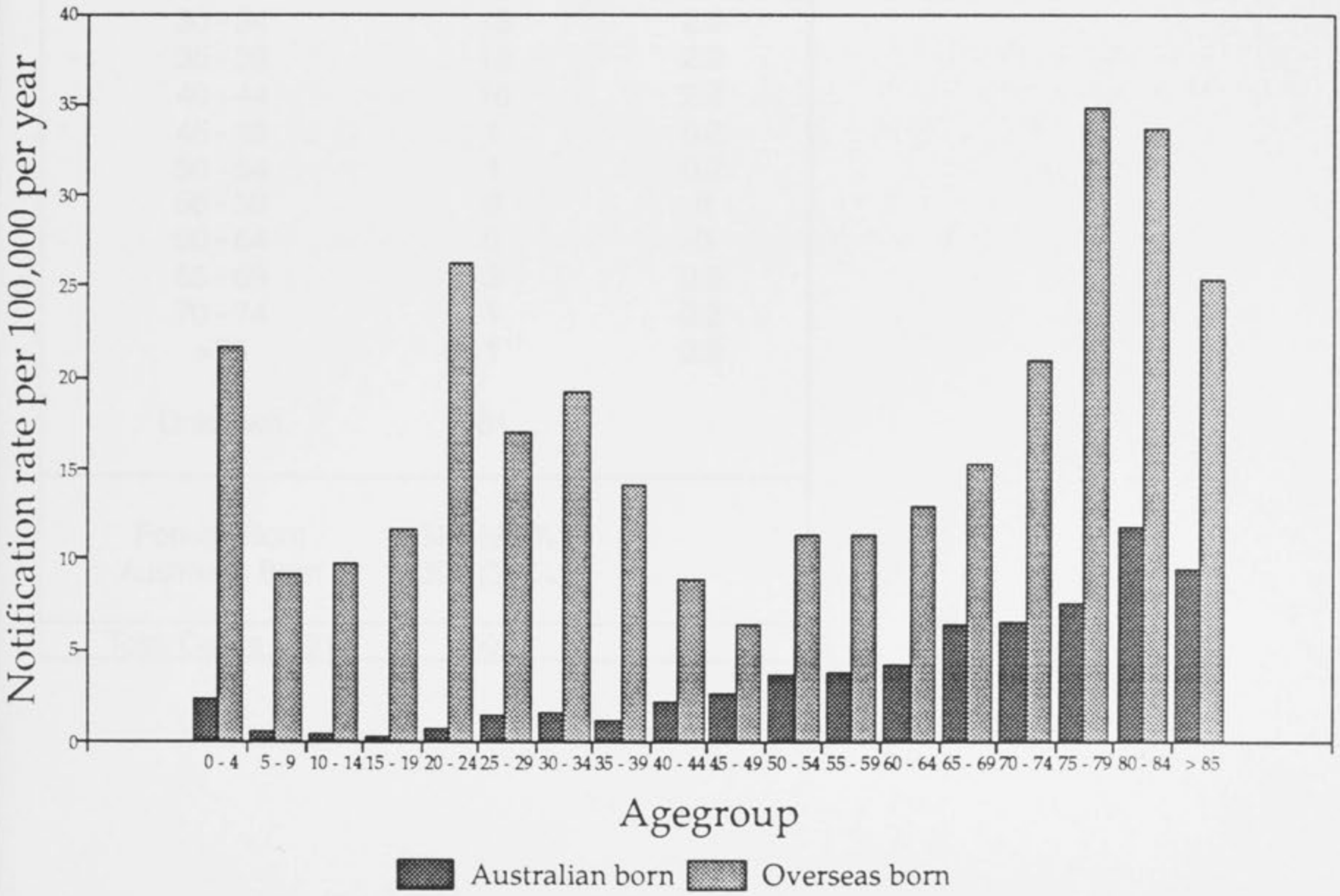


Tuberculosis in Australia, 1986 - 1991

Comparison of Rates* between Australian born and Foreign born



M TB IN AUSTRALIA 1991
Comparison of Age Group Specific Rates



TUBERCULOSIS IN AUSTRALIA 1991

Length of Australian Residence in Foreign Born Cases

Length of Residence (Years)	No Cases	% of Total
0 - 4	269	45
5 - 9	81	14
10 - 14	52	8.7
15 - 19	21	3.5
20 - 24	27	4.5
25 - 29	16	2.7
30 - 34	13	2.2
35 - 39	13	2.2
40 - 44	16	2.7
45 - 49	1	0.2
50 - 54	1	0.2
55 - 59	0	0
60 - 64	0	0
65 - 69	3	0.5
70 - 74	1	0.2
>75	1	0.2
Unknown	81	
Foreign Born	596 (66 %)	
Australian Born	307 (34 %)	
Total Cases 1991	903	

Slide 14

Conclusions :

(1) The rate of new cases of tuberculosis in Australia have been stable since 1986.

(2) The majority of cases of tuberculosis in Australia occur in immigrants.

(3) The age group specific rates are different between oberseas born and Australians, with overseas born having higher rates in all ages but with peaks of increase risk at the under 5, the 20 - 24, and the greater than 75 age groups.

(4) 45% of overseas born cases their disease diagnosed within 5 years of arrival in Australia.

SECTION 4

SECTION 4 SCIENTIFIC PAPERS SUBMITTED FOR PUBLICATION

The following papers were submitted for consideration for publication. These papers are attached.

1 Measles Vaccine Efficacy Study in a Canberra High School : A Study following a measles outbreak. Submitted to the Journal of Paediatrics and Child Health.

3 The Effectiveness of Rubella Vaccine. Submitted as a letter to the Editor of the Medical Journal of Australia.

2 Tuberculosis in Australia, 1986 - 1991 : An analysis of notification data. Submitted to the Medical Journal of Australia.

Journal of
PAEDIATRICS AND CHILD HEALTH

A.C.N.: 004901562

PO Box 378, Carlton, Victoria 3053, Australia Tel (03) 347 0300, Fax (03) 347 5001

23rd November 1992

Dr David Cheah
Communicable Diseases Section
7th Floor Albermale Building
Commonwealth Department of Health,
Housing & Community Service
PO Box 9849
WODEN ACT 2601

Dear Dr Cheah

RE: MSNO 92 135 MEASLES VACCINE EFFICACY STUDY IN A CANBERRA HIGH SCHOOL: A STUDY FOLLOWING A MEASLES OUTBREAR

Thank you for submitting your manuscript to the *Journal of Paediatrics and Child Health*. In accordance with Journal policy, the editors will send the manuscript out for review, and will write to you once the referees' comments are received.

Yours sincerely

Pamela Handasyde
Editorial Assistant

NB: Please sign and return the attached form regarding copyright. Please ensure <u>all</u> authors sign the form. Thank you.

Published for The Australian College of Paediatrics, the Paediatric Research Society of Australia, the Australian Association of Paediatric Surgeons and the Australian Perinatal Society by Blackwell Scientific Publications ■

The Editorial Office

Journal of Paediatrics and Child Health

PO Box 378

Carlton South, Vic 3053

Australia.

To the Editor :

Enclosed, please find the original and two copies of our manuscript entitled "Measles Vaccine Efficacy Study in a Canberra High School : A Study following a Measles Outbreak".

We would like to submit this manuscript to you for consideration for publication in the *Journal of Paediatrics and Child Health.* The paper is an epidemiological analysis of measles vaccine efficacy during a large measles outbreak in Canberra in late 1991.

A brief report of the outbreak was published in the Communicable Diseases Intelligence, Volume 16, Number 6, in 1991, as part of surveillance reporting within the Communicable Diseases Section. Some data from this study were presented to the Scientific Meeting of the Australasian Epidemiological Association, held in Canberra on 27th September, 1992.

Please don't hesitate to write or call if you or your reviewers want additional information.

The corresponding author is :

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Commonwealth Department of Health, Housing &

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Thank you.

Yours sincerely,

David F Cheah J. Michael Lane Irene Passaris

Measles Vaccine Efficacy Study in a Canberra High School :

A Study following a Measles Outbreak.

David Cheah, MBBS, B.Bus, DipRACOG, FRACMA, Epidemiology Registrar, Communicable Diseases Section, Commonwealth Department of Health, Housing & Community Services.

J. Michael Lane, MD, MPH, WHO Consultant, NCEPH.

Irene Passaris, Director, Communicable & Environmental Disease Control Section, ACT Health.

Communicable Diseases Section, Commonwealth Department of Health, Housing & Community Services, Canberra.

National Centre for Epidemiology & Population Health, Australian National University, Canberra.

Communicable & Environmental Disease Control Section, ACT Health, Canberra.

No reprints will be available.

Correspondence : Dr David Cheah, PO Box 9848, Woden, ACT 2601.

Ph (06) 2898416 Fax (06) 2897802

Abstract

The study of vaccine efficacy following an outbreak provides an ideal method of estimating the public health utility of the vaccine.. We investigated an outbreak of measles which occurred in Canberra between October and December, 1991. We determined the measles vaccine efficacy for the 13 to 15 year old children in a selected high school. During the outbreak, at least 82 children contracted measles. Teenage males accounted for 56% of total cases, and 22% of cases were confirmed by serology. The vaccine coverage in the high school studied decreases with increasing Grades, varying from 85.8% in Grade 8 to 79.2% in Grade 10. The highest attack rate occurred in Grade 10 (66 per 1000). The vaccine efficacy for age 13 to 15 was estimated to be 72% (95% Confidence Interval, 45% to 86%) but varies from 67% to 73%. Measles remains a serious disease of childhood in Australia. The elimination of measles is only partly dependent on the vaccine coverage of children. Issues related to the effectiveness of vaccine are also important. A two dose vaccine strategy is supported by the findings of this study.

Key words: Measles; vaccine efficacy; outbreak investigation; epidemiology

Introduction

The high level of measles activity in Australia in 1990 and 1991 resulted in outbreaks in several States (1,2,3,4). In 1991, there was an increase of 57% in notifications compared with 1990, and a large number of notification of measles virus isolation to the CDI "Viruses" Reporting Scheme (5,6). Measles is a potentially fatal, vaccine preventable childhood infectious disease. The NHMRC recommends that all children receive a single dose of measles, mumps, rubella (MMR) vaccine at 12 months of age, unless there are medical contraindications or personal objections (7). Mathematical modelling has indicated that a vaccine coverage of between 92% and 95% is needed to block transmission of measles (8). In 1990, only 89% of Australian children aged 6 years and under, were immunised for measles (9).

In 1991, an outbreak of measles occurred in Canberra from October to the end of December (10). This was the first major outbreak in Canberra since 1990, when an increase in notifications was noted through surveillance reports (11). This article describes the outbreak, and a subsequent measles vaccine study in a Canberra high school, which had the highest attack rate during the outbreak.

Methods

Case definition. We used a case definition derived from the Canadian Diseases Weekly Record (12). We accepted a case of measles if it was notified by a general practitioner, school authority or identified through case finding. A clinical case of measles must have had a generalised maculopapular rash, consistent with measles, lasting for more than three days and at least one other feature from the

following :

- a high fever, greater than 38.3°C or
- cough, coryza or conjunctivitis.

A confirmed case must have serological confirmation. Case finding during the outbreak consisted of following up all cases, and contacts of a clinical or confirmed case.

Outbreak investigation : All cases notified to the Communicable and Environmental Disease Control Section of ACT Health (CEDCS), from October to December 1991, were followed up with a standardised questionnaire. Details obtained included demographic characteristics, clinical data, school data and vaccination status. These were entered into an Epi Info file for analysis. We also identified contacts of reported cases, consulted general practitioners in suburbs where cases occurred, and interviewed principals of primary and secondary schools or cases.

Cohort study : We chose the Canberra high school with the highest attack rate during the outbreak for the vaccine efficacy study. We surveyed children in Grade 8, 9 and 10 (n = 577 children), in February 1992, using a standardised questionnaire. There were 310 male students (53.7%) and 267 female students (46.3%). We did not include Grade 7 because the children had attended different primary schools during the outbreak, and we were not convinced of their exposure status. Non respondents were identified from class registers, and followed up by telephone or home visits. We excluded thirty one students from the study because

they were new to the school or had left school and therefore not contactable. One student was excluded because he developed measles well out of the outbreak time frame. Only one student refused to participate. Parents were asked to view the immunisation records of their children before completing the questionnaire to minimise recall bias. We also checked immunisation data with the ACT Health immunisation records, if the immunisation histories were questionable. All cases had their immunisation history documented by viewing records.

We calculated vaccine efficacy for the 13 to 15 year age group (n = 535), using the following equation :

$$VE\ (\%) = [\ (AR_{(u)} - AR_{(v)}) / AR_{(u)} \times 100 \text{ where}$$

$AR_{(u)}$ is the attack rate in the unvaccinated and

$AR_{(v)}$ is the attack rate in the vaccinated (13,14). Dividing the numerator with the attack rate of the unvaccinated results in the analogous formula :

$$VE = 1 - \text{Relative Risk.}$$

Statistical analysis : We performed statistical analysis on a microcomputer using Epi Info, Version 5, an epidemiological software package developed by the Epidemiology Program Office, Centers for Diseases Control (15). Taylor's series approximation of 95% confidence intervals for vaccine efficacy were obtained by calculating the confidence interval around the relative risk, according to the method described by Orenstein and colleagues (13,14).

Results

Figure 1 presents the outbreak curve. Eight cases occurred in October, fifty in November and twenty four in December. Case ascertainment ceased at the end of December. Four generations of transmission are apparent from the outbreak curve. The school holidays provided a natural break to the transmission of the disease. Eighty two cases fulfilled our case definition during the outbreak. Ten cases (12.2%) could not be contacted for verification despite vigorous attempts. Eight reported cases were excluded from analysis because they did not conform to the case definition, or because they were suspected of having a disease other than measles. Eighteen cases (22%) were confirmed by serology. The male to female ratio was 1.28:1. Twenty four cases (29.3%) occurred in nine primary schools, and fifty two cases (63.4) were from ten secondary schools. Five cases (6.1%) were preschoolers. One case was not in school.

Serologically proven cases occurred in four of the six high schools in Canberra. Spread from school to school probably occurred through family clusters, sporting events and social occasions between schools. There was no proven index case identified among the several high schools. Thirty nine cases (48%) occurred in fifteen family clusters, including four family clusters with serological confirmation. High school students accounted for 84% of all cases in the outbreak. Figure 2 presents the age and sex of the cases; females predominated in the ten to fourteen age group, while males predominate in the fifteen to nineteen year age group. Thirty nine percent of cases gave a history of prior measles vaccination. One high school had 28% of the total cases, and an overall attack rate of 28 per 1,000. We selected this high school for a vaccine efficacy study.

Cohort study on Vaccine Efficacy. Table 1 presents the attack rate and vaccine coverage of Grade 8, 9 and 10 in the high school with the largest number of cases. There were 35 cases of measles in the three grades studied. The vaccine coverage decreases with increasing grade, with Grade 10 having 79.2% of students vaccinated against measles. The attack rate was highest in Grade 10, which was consistent with the age distribution of the entire outbreak.

We selected the 13 to 15 age group (n = 535) for the calculation of vaccine efficacy. Sixteen students in this group did not know their vaccination status, had no records for confirmation and their vaccination history was not verifiable by any other means. These students came from interstate or overseas, and had lost their vaccination records. We excluded one case from analysis who did not conform to our case definition.

Table 2 presents a sensitivity analysis of vaccine efficacy, by varying the way in which the 16 children with unknown vaccine status were classified. Method (a) assumes all were vaccinated. Method (b) assumes all were unvaccinated. Method (c) eliminates them from the analysis. Method (d) distributes them to the vaccinated and unvaccinated group according to the proportions in the children with known vaccination status.

Discussion

In calculating the vaccine efficacy, we tried to minimise some of the biases which may exist in such a study. We used the same case definition for measles in the outbreak and in the vaccine study. We feel that we ascertained all the cases involved in the outbreak, and believe we detected all cases in the three Grades. In

considering the vaccination status of the unknowns, we elected to conduct a sensitivity analysis to identify the range of possible vaccine efficacy. This school provided a situation where both vaccinees and non vaccinees had a high degree of exposure to measles. The results presented here are comparable to similar studies elsewhere (16,17).

Some of the possible explanations for the observed low vaccine efficacy include poor vaccine storage, or method of vaccine administration. The National Health and Medical Research Council recommends that measles vaccine should be stored in the dried state at 2 to 8 degrees Centigrade or colder. A recent study in New Zealand shows that 90% of refrigerators used by general practitioners operate outside the recommended temperature for vaccine viability (18). Potency of vaccines may be threatened by these storage conditions. The vaccine should also be given by subcutaneous injection, and should not be used eight hours after preparation. Waning immunity from primary vaccination due to lack of challenge by wild virus is also a theoretical possibility. Vaccination induces a lower antibody titre response than natural infection. The degree to which these levels are reinforced by subsequent exposures to natural measles in the community is not known. Immunisation may have been performed on this cohort in the wrong age group, leading to poor seroconversion. We were not able to determine the age of vaccination in this study.

Measles remains a serious public health problem in school children, with the highest age specific attack rates shifted to high school children. In the United States, the greatest recent increase in cases has been among children under five years old (19). In Australia, the strategy for the elimination of measles has been

directed towards vaccine coverage of children. Issues relating to the effectiveness of the vaccine are also important. A single infant vaccination schedule may not provide durable immunity due to the possibility of waning immunity from the lack of challenge by wild virus. The two dose measles vaccination policy recently proposed by the National Health and Medical Research Council remains a prudent option to hasten the elimination of this disease in the community.

Acknowledgment :

The authors would like to acknowledge the help provided by Dr Robert Scott, former Chief Health Officer, ACT and Mr Ray Gunn, Principal of Lyneham High School, ACT.

References

1 Measles - CDI Laboratory Reporting Scheme and National Notifiable Diseases Data. Communicable Diseases Intelligence. 1991;15:313-316.

2 Taylor L. Catching a measles outbreak. NSW Public Health Bulletin. 1991;7:65-69.

3 Weinstein P, Carrangis J. Measles resurgence in South Australia. Communicable Diseases Intelligence. 1991;15:312-313.

4 Gill J, Marshall L. Measles outbreak in Collie, WA. Communicable Diseases Intelligence. 1991;15:150-151.

5 Anura P, Hall R. Annual Report of the National Notifiable Diseases Surveillance System, 1991. Communicable Diseases Intelligence. 1992;16:334-346.

6 Hargreaves J. Annual Report of the CDI 'Viruses' Reporting Scheme, 1991. Communicable Diseases Intelligence. 1992;16:206-222.

7 National Health and Medical Research Council. Immunisation Procedures. 4th Edition. AGPS. 1991.

8 Anderson R, May R M. Immunisation and herd immunity. In: Moxon E R. (editor). Modern Vaccines:Current Practice and New Approaches. London. Edward Arnold. 1990:25-26.

9 Australian Institute of Health and Welfare. Australia's Health 1992. Australian Government Publishing Service. Canberra. 1992.

10 Cheah D. Measles outbreak in Canberra. Communicable Diseases Intelligence. 1991;16:114-117.

11 Scott R J, Passaris I. Measles notifications received in the ACT:January to October, 1990. Communicable Diseases Intelligence. 1990;25:8-9.

12 Canadian Communicable Disease Surveillance System. Disease Specific Case Definitions and Surveillance Methods. Canada Diseases Weekly Report. 1991;17S3:23.

13 Orenstein W A et al.: Field evaluation of vaccine efficacy. Bulletin of the World Health Organisation. 1985;63:1055-1068.

14 Orenstein W A, Bernier R H, Hinman A R. Assessing vaccine efficacy in the field : further observation. Epidemiology Reviews. 1988;10:212-241.

15 Dean A D, Dean J A, Burton A H, Dicker R C. Epi Info. Version 5:a word processing, database, and statistics program for epidemiology on microcomputers. USD, Incorporated, Stone Mountain, Georgia, 1990.

16 Harrison G P, Durham G A. The 1991 Measles Epidemic:how effective is the vaccine?. New Zealand Medical Journal. 1992;105:280-282.

17 Robertson S E, Markowitz L E, Berry D A, Dini E F, Orenstein W A. A Million Dollar Measles Outbreak:Epidemiology, Risk Factors, and a Selective Revaccination Strategy. Public Health Reports. 1992;107:24-31.

18 Henzell M C. Handling and Storage of Vaccines in Bay of Plenty General Practices. Communicable Disease New Zealand. 1992;92:65.

19 The National Vaccine Advisory Committee. The Measles Epidemic. Journal of the American Medical Association. 1991;266:1547-1552.

Figure 1 - Measles Outbreak, Canberra, October - December, 1991

82 Cases by Date of Onset of Symptoms

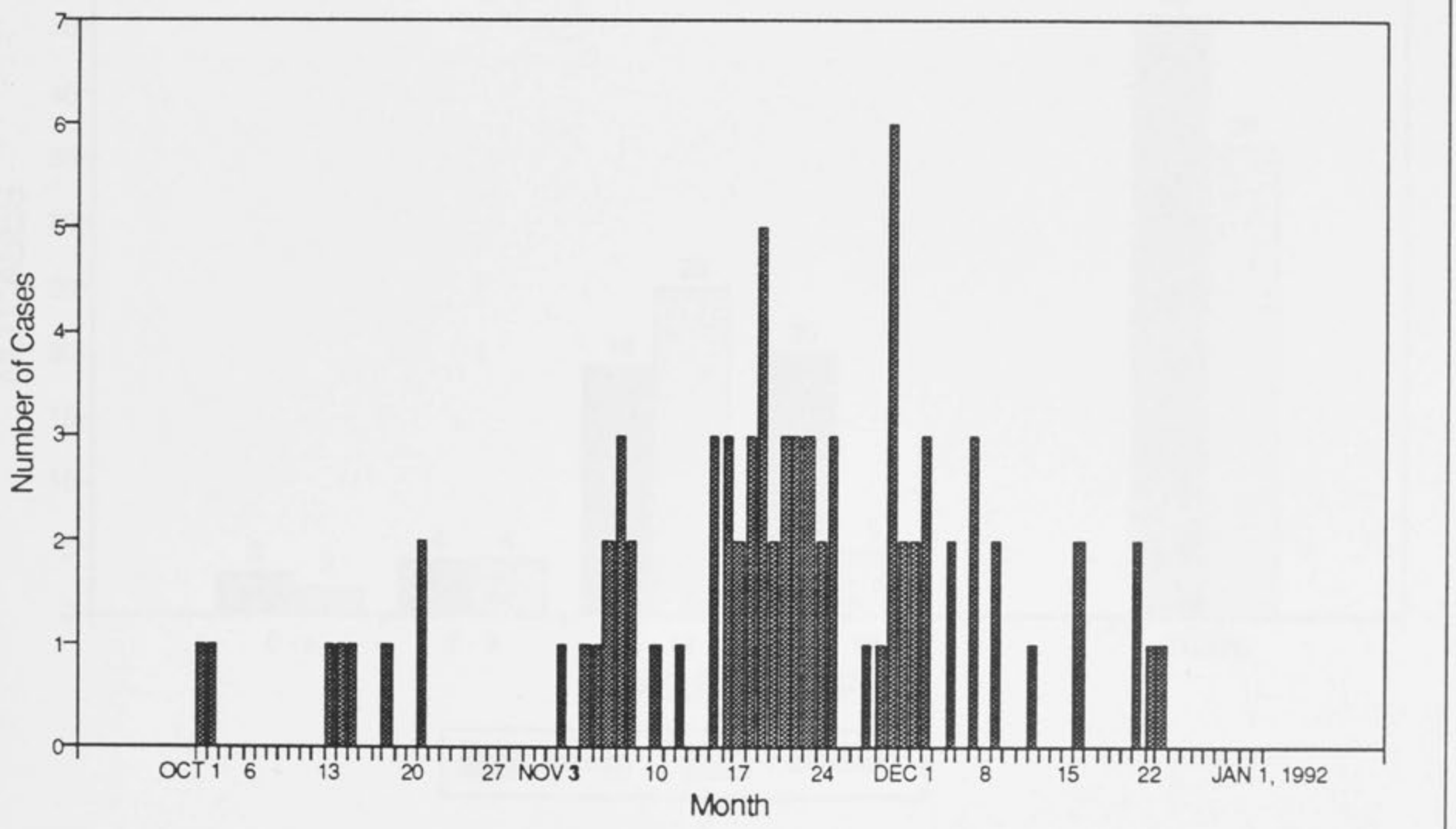

Figure 2 - Measles Outbreak, Canberra, October - December, 1991

82 Cases by Age and Sex

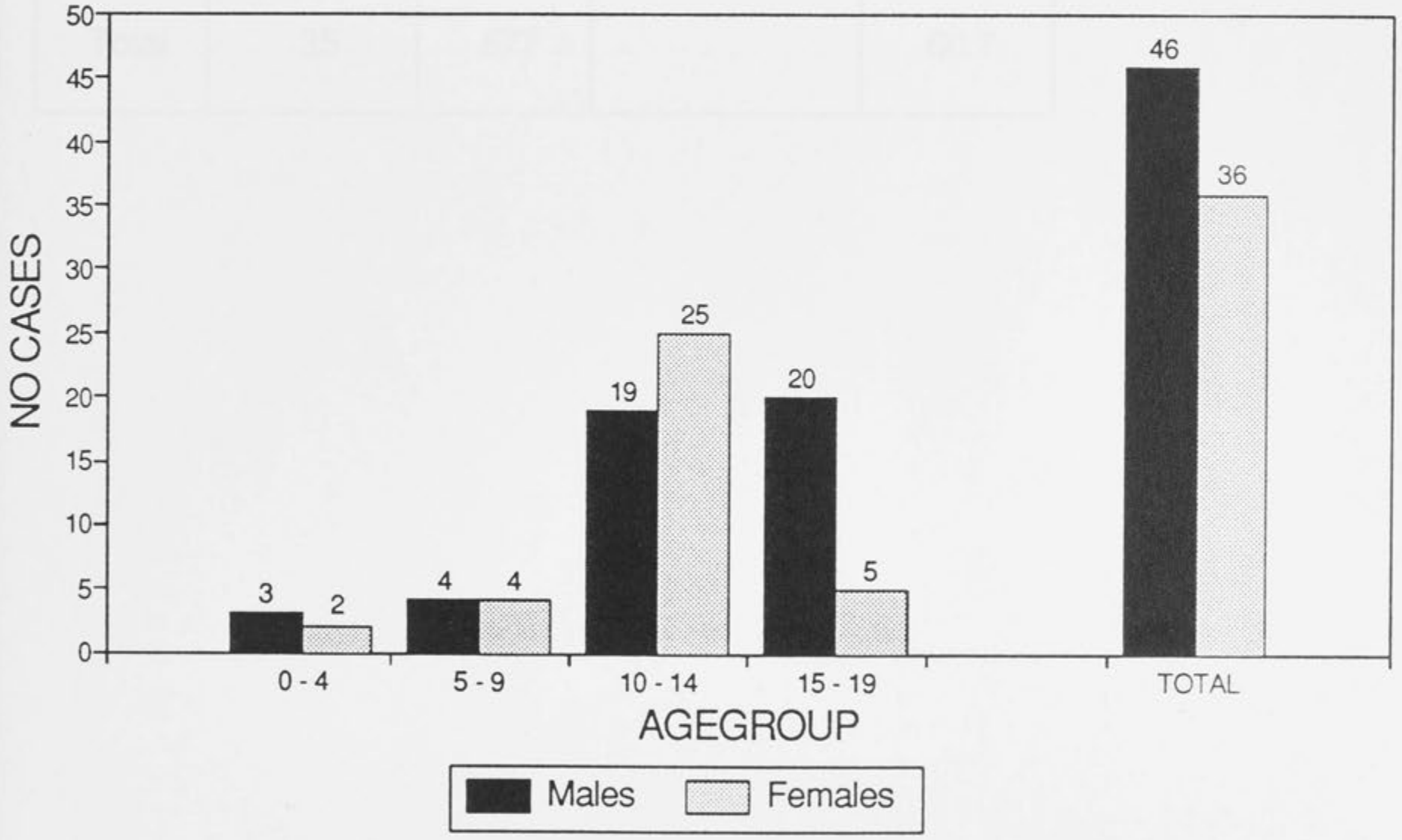

Table 1- Attack Rate and Vaccine Coverage by Grade in a Canberra High School, 1992.

Grade	Number of Cases	School Census	Vaccine Coverage (%)	Attack Rate/1000
8	11	179	85.8	61.5
9	11	201	82.6	54.7
10	13	197	79.2	66
Total	35	577		60.7

Table 2 - Measles Vaccine Efficacy for 13 to 15 year old children in a Canberra High School, February, 1992.*

* with Four Methods of Handling Unknown Vacinees

Method	Vaccine Efficacy (%)	95% Confidence interval
(a)	73	48 , 86
(b)	67	35 , 83
(c)	72	46 , 86
(d)	72	45 , 86

(a) As Vaccinated
(b) As not Vaccinated
(c) Disregarded in the analysis
(d) Proportionated

The Medical Journal of Australia

JOURNAL OF THE AUSTRALIAN MEDICAL ASSOCIATION

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Please quote our ref: 92-20677.CHE 15 January 1993

Dr David Cheah
Communicable Diseases Section
DHH & CS
Canberra ACT 2601

Dear Dr Cheah,

Thank you for sending us your Letter to the Editor "The effectiveness of rubella vaccine".

Our reviewer felt it should be published, but that some additional information is required:

1. How many of the 44 cases of rubella occurred in vaccines? In particular, had the six females been vaccinated?;

2. How many of the 587 children who responded to the questionnaire had been vaccinated?;

3. Was there documentation of the vaccinations;

4. Please define AR(u) and AR(v).

We look forward to receiving the revised Letter as soon as possible.

Yours sincerely,

(Dr) Jill Forrest
Joint Editor

JF/JS

The Medical Journal of Australia

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PLEASE QUOTE OUR REF: 92-20677

18 December 1992

re: "The effectiveness of rubella vaccine"

Dear Dr Cheah,

The Editors wish to acknowledge your contribution, which will have their attention.

The Editor

Medical Journal of Australia

1 Commercial Road

Kingsgrove NSW 2208

The Effectiveness of Rubella Vaccine

To the Editor :

The current national outbreak of rubella has resulted in 1844 cases being reported to the Commonwealth Department of Health, Housing and Community Services, between 1 January and 31 October this year (1). In the ACT, from the beginning of September 1992 to the end of October 1992, over 300 cases of rubella were reported to the Communicable and Environmental Control Section of the ACT Board of Health. This outbreak was identified by school authorities, who reported a significant absentee rate among high school children. The widespread nature of the disease in Canberra prompted us to conduct a survey in a Canberra high school to determine the effectiveness of rubella vaccine.

A school girl immunisation program where girls are offered immunisation against rubella at the age of 12 has been in place since the early 1970s . We surveyed all students in Years 11 and 12 in the high school which had the largest number of cases. A survey instrument was completed during class time. Five hundred and seventy eight responses were obtained from the school population of 850 students (68%). The remaining two hundred

and seventy two students (32%), were not present at the school on the day of the survey, due to school examinations and other social activities associated with the end of the academic year. Forty four cases of rubella were reported. In this group, 38 cases were males (13.4%) and 6 cases were females (2.1%). Vaccine efficacy was calculated using the standardised formula (2,3) :

$$\text{Vaccine efficacy} = \frac{AR(u) - AR(v)}{AR(u)} \times 100$$

The rubella vaccine efficacy was 92%, with a 95% Confidence Interval between 95% and 82% .

In the light of the current, high incidence of rubella, it is reassuring to note that rubella vaccination in prepubertal girls is effective and prevented a substantial number of cases in teenager girls in this school. The recent recommendations of the NHMRC for a second dose of MMR for all children will result in a further reduction in the pool of wild rubella virus from adolescent and adult male population (4).

References

1 National Notifiable Diseases Surveillance System 18 October to 31 October 1992. Communicable Diseases Intelligence 1992;16:505-508.

2 Orenstein W A et al. : Field evaluation of vaccine efficacy. Bulletin of the World Health Organization 1985;63:1055-1068.

3 Orenstein W A, Bernier R H, Hinman A R. Assessing vaccine efficacy in the field : further observation. Epidemiology Reviews 1988;10:212-241

4 National Health and Medical Research Council. Report of the 114th Session. November 1992. Canberra.

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Chief Health Officer, ACT Health.

Irene Passaris

Director

Communicable & Environmental Disease Control Section, ACT Health.

7th December 1992.

TUBERCULOSIS IN AUSTRALIA, 1986 - 1991.

An Analysis of Notification Data.

David F Cheah, MBBS, B.Bus, DipRACOG, FRACMA, Epidemiology Registrar.

Robert Hall, BSc (Med), MBBS, MPH, DipRACOG, FAFPHM, FRACMA, Director.

* Aileen Plant, MBBS, DTM & H, MPH, FAFPHM, Senior Research Fellow.

* J Michael Lane, MD, MPH, WHO Consultant.

* Communicable Diseases Network (Australia)

Communicable Diseases Section, Commonwealth Department of Health, Housing & Community Services, Furzer Street, Woden, ACT 2601.

* National Centre for Epidemiology & Population Health, ANU, Canberra.

No reprints will be available. Correspondence : Dr Robert Hall

Objectives :

(1) To describe the epidemiology of new cases of *Mycobacterium tuberculosis* in Australia, notified between 1986 and 1991.

(2) To describe the characteristics of foreign born cases notified in 1991.

Design :

(1) Analysis of existing notification data from 1986 to 1987.

(2) Analysis of newly collected data from 1988 to 1990.

(3) Analysis of 1991 surveillance data.

Setting :

The Communicable Diseases Section of the Commonwealth Department of Health, Housing and Community Services, using data supplied by State and Territory Health Departments.

Participants :

Each State and Territory Health Department submitted data for 1988, 1989, 1990 and 1991, years for which national data were previously unavailable. Previously available data for 1986 and 1987 were included in this analysis.

Main outcome measures :

Data from the three sources were pooled to obtain the incidence of notification of new cases, site of disease, age of notified cases, and trends in the country specific rates of tuberculosis in foreign born persons, between 1986 and 1991. The foreign

born cases notified in 1991 were analysed separately to identify age specific rates, and the length of residence in Australia.

Results :

A total of 5503 cases of tuberculosis were reported in Australia between 1986 and 1991. The notification rate per year was constant between those years. Males were more likely than females to have had pulmonary or pleural disease (RR=1.19, 95% CI, 1.15 - 1.23), whilst females were more likely to have had lymphatic tuberculosis (RR=2.56, 95% CI, 2.19 - 3.01), skeletal tuberculosis (RR=1.44, 95% CI, 1.05 - 1.98) and tuberculous meningitis (RR=2.89, 95% CI, 1.54 - 5.44).

In 1991, 66% of new cases were foreign born; 19% of these cases were notified within 12 months of arrival in Australia. The rate of notifications in foreign born persons was 6.5 times that in Australian born persons, with the highest rates of notification for the under nine, the 20 to 24 age group and in those older than 80 years. Foreign born cases were more likely to have had extrapulmonary tuberculosis (RR=1.72, 95% CI, 1.33 - 2.23), and in particular, lymphatic tuberculosis, (RR=2.84, 95% CI, 1.8 - 4.5) and genito/urinary tuberculosis (RR=3.31, 95% CI, 1.33-7.38).

Conclusion :

Tuberculosis in Australia is mainly a disease of migrants. Cases from migrants have different characteristics from cases who are born in Australia. Further control of tuberculosis in foreign born persons would result in a significant reduction in the disease in Australia.

Introduction

Tuberculosis remains a serious problem today. An estimated eight million cases occurred in the world in 1990, with more than 4.5 million cases occurring in the Asian region (1). The World Health Organization estimates that one third of the total world population is infected with *Mycobacterium tuberculosis*, and that this disease may be the most common cause of death due to an infectious agent (2). In the United States, the number of tuberculosis cases reported to the Centers of Disease Control has been increasing since 1985, and in 1990 there were more than 26,000 cases (3,4). In Australia, the successful Australian Tuberculosis Campaign conducted from 1948 to 1976, and concurrent social changes resulted in the tuberculosis rate falling from over 50 cases per 100,000 per year in 1950 to below 10 per 100,000 per year since the early 1980s (5,6,7,8). We are presenting data provided by State and Territory Health Departments to describe the epidemiology of tuberculosis in Australia between 1986 and 1991.

Methods

Prior to 1985, tuberculosis statistics for Australia were derived by combining data provided to the Commonwealth Department of Health as summary statistics for each year by the State and Territory Health Departments. The collation and subsequent analysis were limited because of the inability to analyse the variables for individual cases. Prior to 1985, the rates for tuberculosis and atypical mycobacteria were reported in a combined form. We have reported these separately. The natural history of both forms of tuberculosis, their public health

implications, the advent of HIV disease and its potential impact on *Mycobacterium tuberculosis* and atypical mycobacteria strongly suggests that these two categories should be analysed separately. It is now widely appreciated that the diagnosis of tuberculosis in HIV infection may be difficult because of atypical presentation and the increased prevalence of sputum negative cases (9). In this study, we excluded atypical mycobacteria from the calculation of rates of tuberculosis. We analysed previously available notification data from 1986, 1987 and 1988. We requested data from 1988 to 1990, using the previous data collection format. This data collection was commenced in early 1991 and completed in September 1991. Under the auspices of the Communicable Diseaes Network of Australia, we also devised a new system of surveillance, based on individual (but not identifiable) case records. All States and Territories contributed data in this format for 1991.

The case definition for tuberculosis was constructed with assistance from the various contributing States and Territories. A case of tuberculosis was defined as one which has bacteriological confirmation (by culture or microscopy), or which has clinical features consistent with active disease and is accepted by the Director of Tb in each State or Territory. Cases of M*ycobacterium bovis* and *Mycobacterium africanum* were included but not cases of BCG-Bovis. We obtained denominators for the different population grouped by country of birth, from the Australian Bureau of Statistics. The population used was the mid year estimate of population each year. The incidence rate of new notifications is defined as the rate of new notifications per 100,000 per year. We performed statistical analysis using Epi Info, version 5, including confidence intervals around the relative risk, derived from Taylor's series (10).

Results :

Figure 1 shows the overall rate of notification of new cases between 1986 and 1991. There is no major change in trends in the overall rate, although 1991 has the lowest overall notified rate, and the lowest overseas born rate in six years. The overseas born rate varies from 6 times the rate of Australian born in 1986, to 8.5 times the rate in 1990.

Figure 2 shows the site of disease and gender of the cases notified. Between 1986 and 1991, there were 5503 cases of Tb reported, with 3161 males (57.4 %) and 2342 (42.6 %) females (male:female ratio = 1.3:1). Pleural site is included with pulmonary site so that comparisons can be made with data from previous years. Males are more likely than females to get pulmonary or pleural disease (RR = 1.19, 95% CI, 1.15 - 1.23). Females are more likely than males to get tuberculosis in the lymphatic area (RR = 2.56, 95% CI, 2.19 - 3.01), skeletal area (RR = 1.44, 95% CI, 1.05 - 1.98) and in the meninges (RR = 2.89, 95% CI, 1.54 - 5.44).

The foreign born notifications were analysed separately. Foreign born cases were more likely than Australian born cases to get tuberculosis in the extrapulmonary areas (RR = 1.72, 95% CI, 1.33 - 2.23), and in particular, in the lymphatic area (RR = 2.84, 95% CI, 1.8 - 4.5) and in the genito/urinary area (RR = 3.31, 95% CI, 1.33 - 7.38).

Figure 3 shows the age specific rates for male and female cases between 1986 and 1991. Males rates are twice those of females, from the 55 to 64 year age group onwards. Female rates are higher than males in the fifteen to twenty four and twenty five to thirty four year age group.

Figures 4 through 6 and Table 1 present the analysis of foreign born cases in

1991. Persons born overseas have higher rates than persons born in Australia in all age groups. This is particularly pronounced in the young (under nine), the twenty to twenty nine year age group, and the elderly. Of all the foreign born cases notified, 22.1% occurred within twelve months of arrival in Australia and another 29.9% within five years. Cases continue to be notified after more than fifty years in Australia, although the majority (67.7%), were notified within ten years.

In 1991, the five countries with the highest rate of notification are from South East Asia : Vietnam (116.9 per 100,000), China (64.2 per 100,000), Philippines (63.2 per 100,000), India (55 per 100,000) and Indonesia (53.7 per 100,000). The trend of notifications within the last six years for these countries was not constant. There has been a decrease in rates of notified cases coming from Vietnam and Philippines but an increase in notified rates coming from India and Indonesia. The rate of notification from Philippines fell from 141.6 per 100,000, in 1986 to 63.2 per 100,000 in 1991 whilst the rate of notification from Vietnam fell from 148 per 100,000, in 1986, to 116.9 per 100,000 in 1991. There has been a rise in notification rates coming from Indonesia, from 28 per 100,000, in 1986, to 53.7 per 100,000 in 1991.

Discussion

In industrialised countries with reasonably good public health like Australia, the rate of notification of new tuberculosis probably reflects the true incidence of the disease. Most of the population has access to health care services, and case reporting is mandatory. Our data suggest that tuberculosis control within Australia

is generally successful, and the disease is now largely within certain parts of the migrant community (11,12). Tuberculosis in Australia occurs in two distinct populations. The Australian born population, like most industrialised countries, has a low prevalence of infection among those less than 50 years old. This is a reflection of the rapidly declining risk of infection in the post war years and indicates that an increasing proportion of cases will continue to occur in the elderly. The disease in the migrant population has a pattern similar to developing countries. The majority of infected individuals are below 50 years of age, because the annual risk of infection in their country of birth is still high.

Several recent studies indicate that migrants have a higher rate of disease than the native born of the recipient country. In Canada, the migrant rate is six times that of native Canadians (13). In the United States, foreign born notifications accounted for only 22.6% of the total notifications in 1987, yet immigrants from Asian countries have a risk of developing tuberculosis of 200 to 300 per 100,000. (14) In a cohort study of refugees entering the United States, the annual incidence of new cases decreased from 306 per 100,000 at the time of migration, to less than 50 new cases per 100,000 during the fourth and fifth year. This is attributed to the use of isoniazid as preventive therapy.(15)

Where an industrialised country accepts migrants from a developing country, the rate of tuberculosis in the recipient country will inevitably be altered by the importation of new disease. The challenge to the control program in Australia is to detect and treat the disease in new immigrants, prior to their arrival in Australia. Surveillance of tuberculosis needs to be continued with vigour, and drug resistance trends in migrants must be monitored. New migrants should be helped to comply

with the treatment protocols and health undertakings that they have promised to fulfil. Tuberculosis has the potential to affect everyone. The burden of responsibility must be shared by all; patients, health care providers, State and Commonwealth Government and the community.

Acknowledgments :

The authors would like to acknowledge the contribution made by the following people and organisations :

Dr M Levy, NSW Department of Health, Dr A Patel, P Derhy, Qld Health, Dr J Streeton, Melbourne, P Morris, Health Department Victoria, Dr J Gill, WA Health Department, Dr R Antic, Dr A Thornton, SA Health Commission, Dr V Krause, NT Department of Health & Community Services, Dr R Scott, E Collett, ACT Board of Health and Dr A Misrachi, Dr T Watson, Tasmanian Department of Health.

References :

1 Sudre P., ten Dam G., Kochi A. Tuberculosis : a global overview of the situation today. Bulletin of the World Health Organization. 1992;70(2):149-159.

2 Kochi A. The global tuberculosis situation and the new control strategy of the World Health Organization. Tubercle. 1992;72:1-6.

3 Jereb JA, Kelly GD, Dooley SW, Cathuen GM, Snider DE. Tuberculosis Morbidity in the United States : Final Data, 1990. MMWR Vol 40,No.SS-3.

4 Rieder HL, Cathuen GM, Kelly GD, Bloch AB, Snider DE. Tuberculosis in the United States. Journal of the American Medical Association. 1989;262:385-389.

5 Tuberculosis Briefs 1 - Notification Rates. Communicable Diseases Intelligence. 1991;15:267-269.

6 Tuberculosis Notification Rates, Australia - Final Data for 1986 to 1990. Communicable Diseases Intelligence. 1991;16:234-236.

7 Tuberculosis Notification Rates, 1991. Communicable Diseases Intelligence. 1992;16:398-400.

8 Porter RM, Boag TC. The Australian Tuberculosis Campaign 1948 - 1976. The Menzies Foundation. 1991.

9 World Health Organization. Tuberculosis/HIV Research:Report of a WHO Review and Planning Meeting, Geneva, 24-26 February 1992.

10 Dean AD, Dean JA, Burton AH, Dicker RC. Epi Info. Version 5:a word processing, database, and statistical program for epidemiology on microcomputers. USD, Incorporated, Stone Mountain, Georgia, 1990.

11 Plant AJ, Rushworth RL, Wang QN, Thomas M. Tuberculosis in New South Wales. The Medical Journal of Australia. 1991;154:87-89.

12 Tuberculosis Briefs 2 - Tb by country of birth. Communicable Diseases Intelligence.1991;15:440-442.

13 Wang JS, Allen EA, Chao CW, Enarson D, Grzybowski G. Tuberculosis in British Columbia among immigrants from five Asian countries, 1982-85. Tubercle. 1989;70:179-186.

14 Powell KE, Meador MP, Farer LS. Foreign born persons with tuberculosis in the United States. American Journal of Public Health. 1981;71:1223-1227.

15 Nolan CM, Elarth AM. Tuberculosis in a Cohort of Southeast Asian Refugees. A five year surveillance study. American Review of Respiratory Disease. 1988;137:805-9.

Figure 1 - Tuberculosis in Australia, 1986 - 1991.

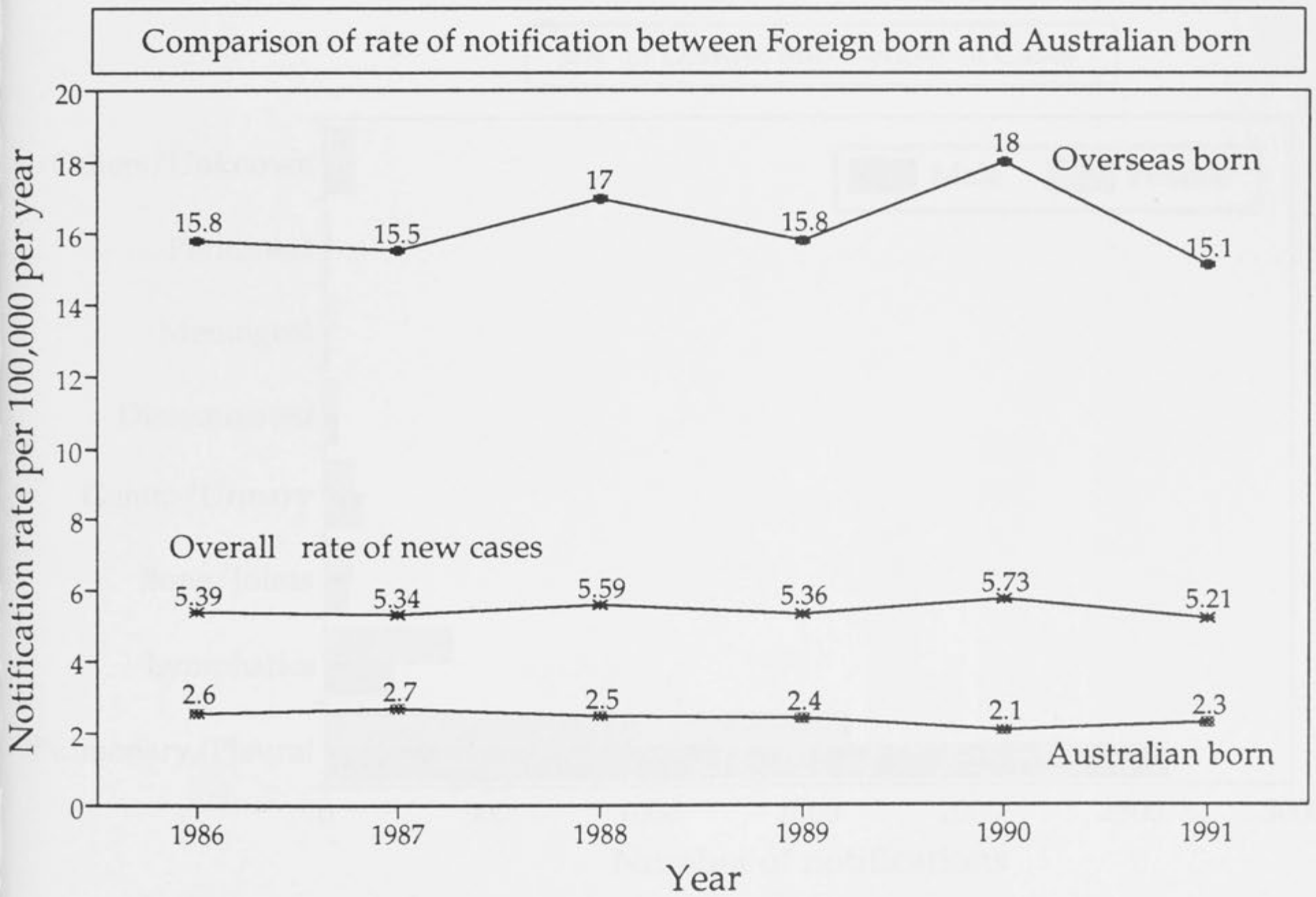


Figure 2 - Tuberculosis in Australia, 1986 - 1991.

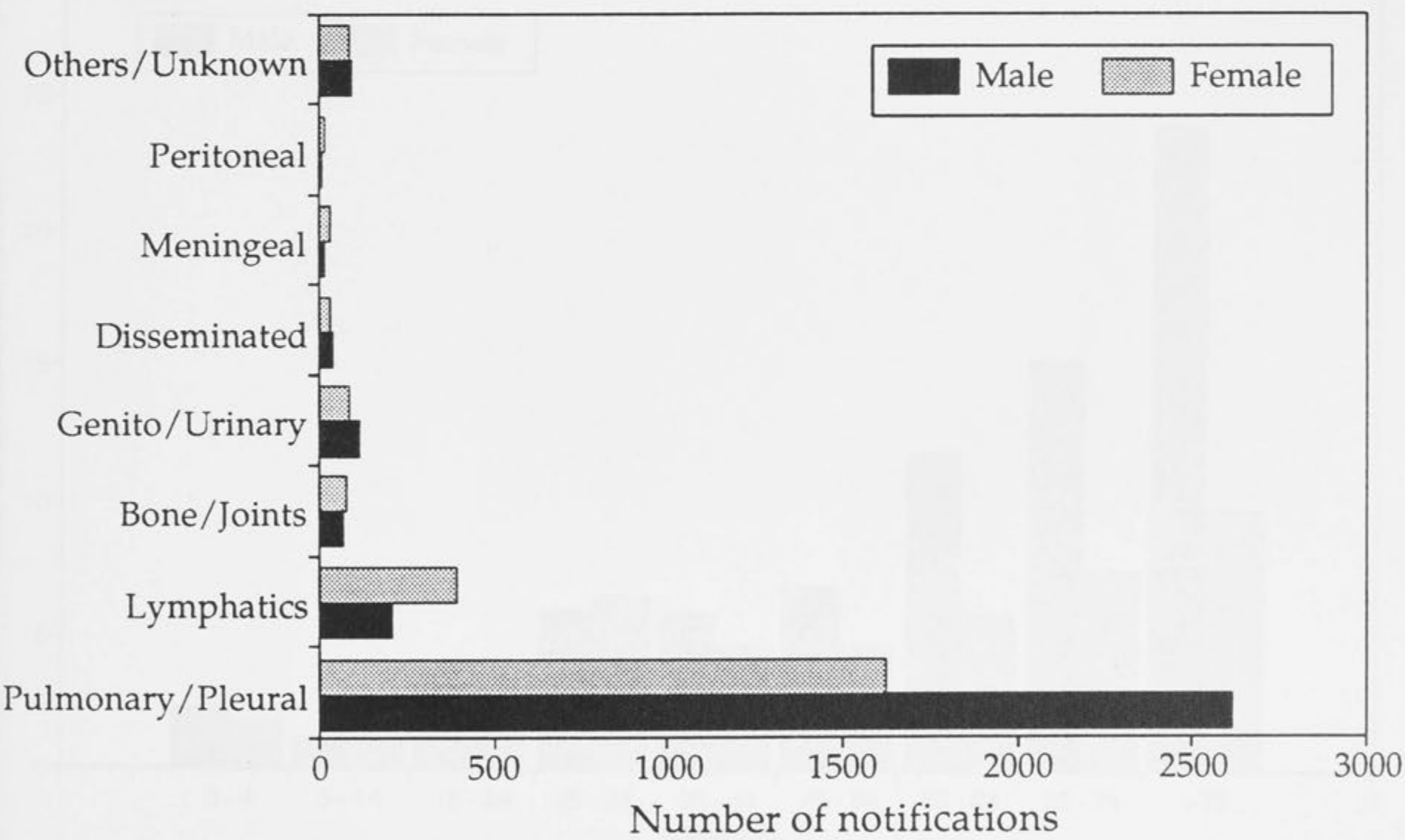


Figure 3 - Tuberculosis in Australia, 1986 - 1991.

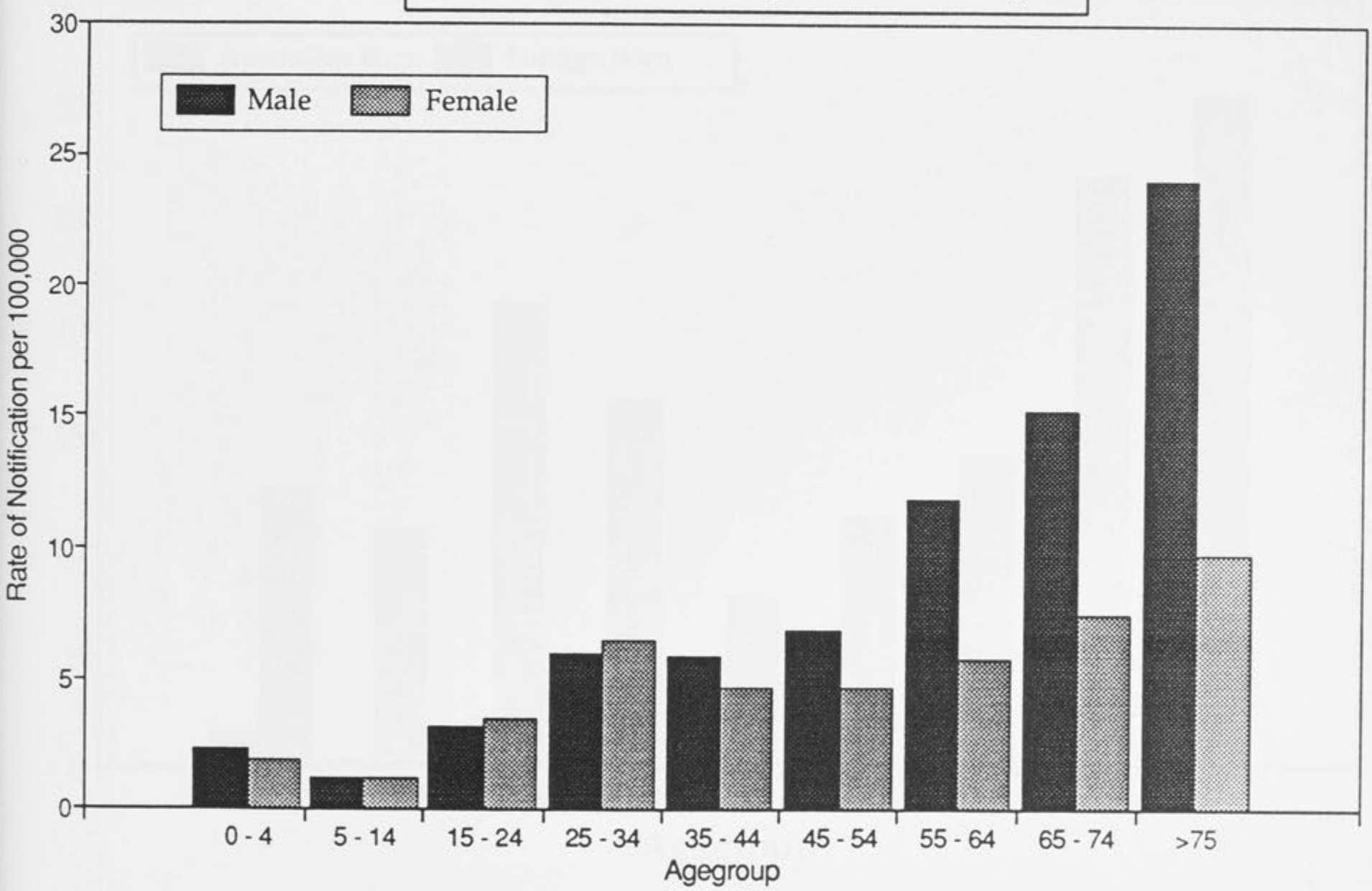


Figure 4-Tuberculosis in Australia,1991
Comparison of Age Specific Rates

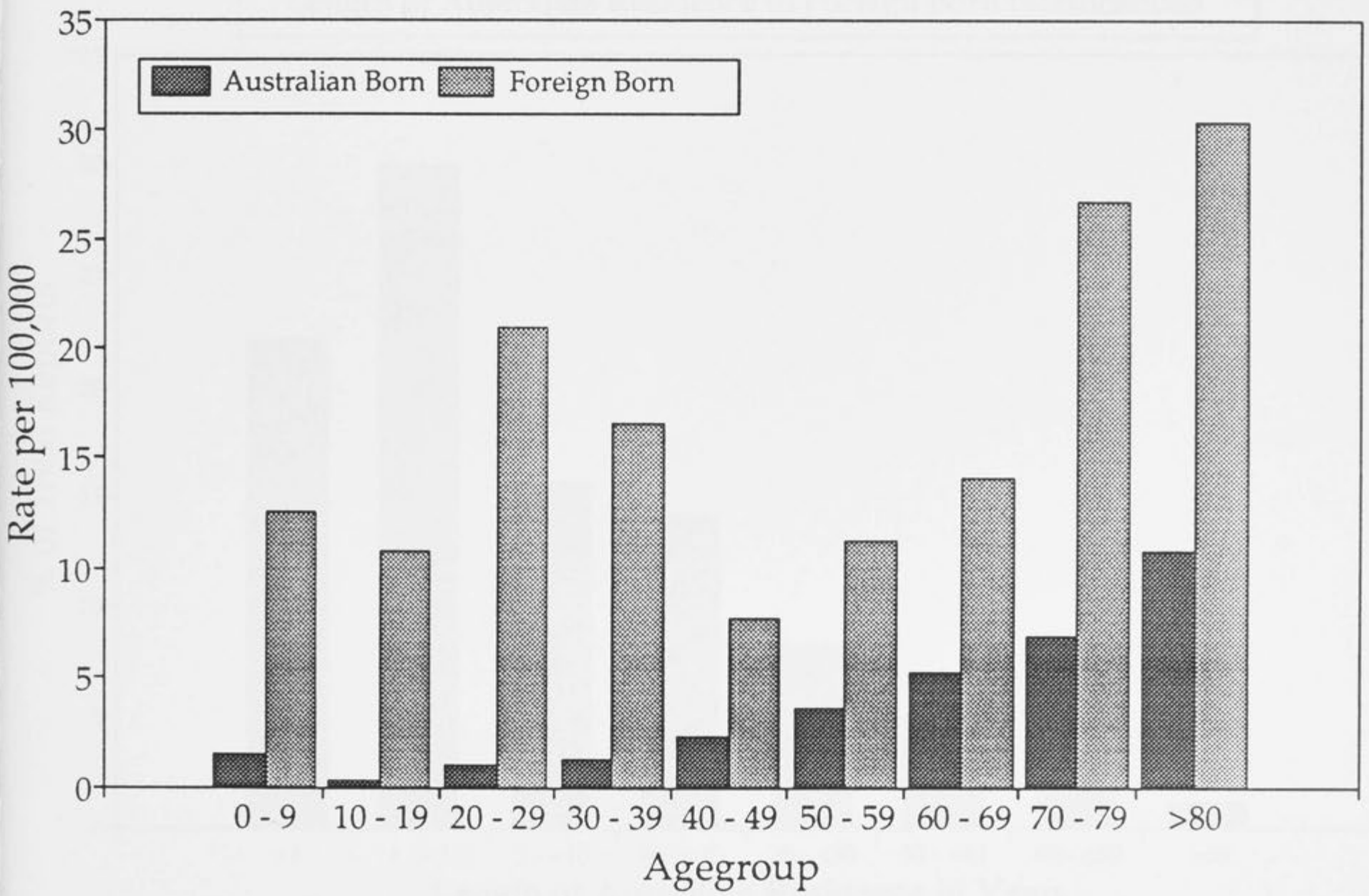


Figure 5 - Tuberculosis in Australia, 1991

Length of Australian Residence in Foreign Born Notifications

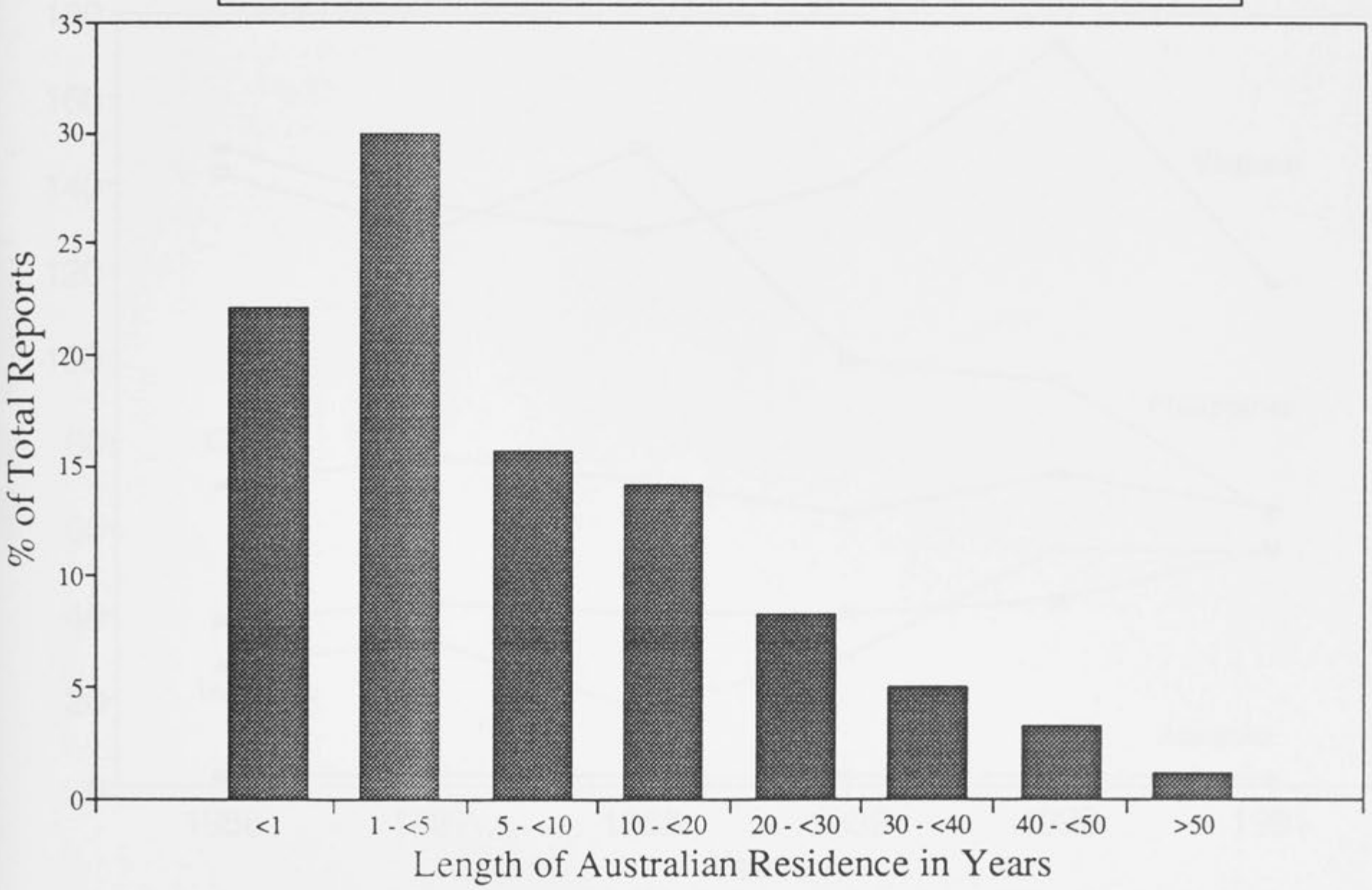


Figure 6 - Tuberculosis in Australia, 1991

Comparison of rates by country of birth

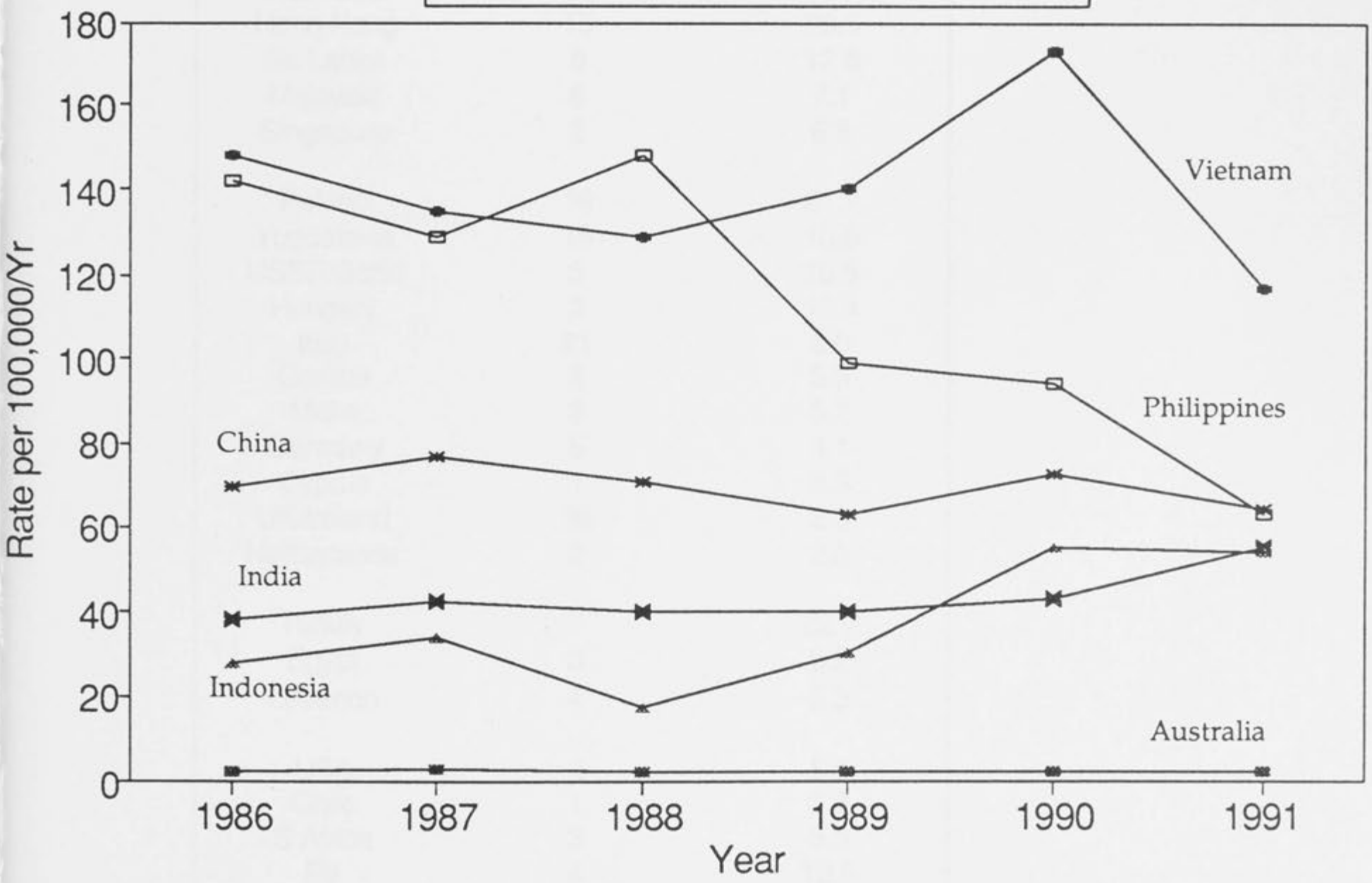


Table 1 - Tuberculosis in Australia, 1991.

Rate of new cases by country of birth, 1991*

Country of Birth	Number of Reports	Rate per 100,000
Australia	307	2.3
Vietnam	156	116.9
China	44	64.2
Phillipines	47	63.2
India	36	55.0
Indonesia	18	53.7
Hong Kong	15	20.5
Sri Lanka	5	12.8
Malaysia	6	7.1
Singapore	2	6.8
Poland	16	21.7
Yugoslavia	18	10.8
USSR/Baltic	5	10.6
Hungary	3	10.4
Italy	21	8.0
Greece	8	5.5
Malta	3	5.2
Germany	5	4.1
Cyprus	1	3.8
UK/Ireland	36	2.9
Netherlands	2	2.0
Turkey	7	22.7
Egypt	3	8.2
Lebanon	4	5.3
USA	3	5.4
Chile	1	3.8
S Africa	3	5.5
Fiji	4	13.5
NZ	4	1.4

* Rates are derived using country specific denominators from the ABS.
* Selected countries only.

SECTION 5

SECTION 5 REVIEW OF A COMMUNICABLE DISEASES SURVEILLANCE SYSTEM

Between 1991 and 1992, I undertook to review three surveillance systems of notifiable disease. These are described below :

1 The National Tuberculosis Surveillance System.

This system was reviewed along the guidelines supplied by the Centers for Disease Control (1).

Historical perspective : Prior to 1985, surveillance of tuberculosis was carried out by a yearly survey of notification data of States and Territories Health Departments. These data were collected in a summary tabular format and were analysed. Reports of this analysis, called "Tuberculosis Statistics" were published and distributed to all the Directors of Tuberculosis in each State or Territory. Summary data continued to be sent to the Communicable Diseases Section since 1986, in a sporadic manner, but were not analysed. These summary data were limited in analysis because of the lack of data on individual records.

Public health importance of tuberculosis : Tuberculosis is a disease of significant public health importance, with an annual notification of between 900 and 1000 new cases from all States and Territories. The incidence of tuberculosis and the trends had not been analysed since 1985. Since 1948, the rate of new notifications had fallen from over 50 per 100,000 per year, to less than 10 per 100,000 per year in the early 1980's. In the United States,

there was an increase in notifications of new cases of tuberculosis since 1985. Articles and comments in peer reviewed journals in Australia, have indicated that tuberculosis might be increasing here as well.

Case definition : From the point of view of comparability and consistency, case definitions need to be agreed upon and categories of tuberculosis defined. The separation of non tuberculous mycobacteria and mycobacterial disease was essential because of the potential influence of HIV disease on tuberculosis.

System attributes : In terms of the attributes of the old system of tuberculosis surveillance, the following could be said.

- **Simplicity :** it was not a simple system for surveillance as the data were presented in a static tabular fashion and the manipulation of data was not possible.

- **Flexibility :** it was not flexible, as data were not transferable. The tabular data that were obtained were difficult to analyse electronically These had to be analysed manually instead.

- **Acceptability :** the reports of the analysis "Tuberculosis Statistics" were acceptable to clinicians. They provided trends of the disease since 1948 but it was not robust because of the tabular presentation.

- **Sensitivity :** it was sensitive as it recorded all new cases of **reported** tuberculosis (both for non tuberculous mycobacteria and mycobacteria). It was assumed that all new cases of tuberculosis are reported to health authorities. However, it was dependent on the surveillance vigour of the heath system in obtaining data. A decrease

in notification may not be due to a decrease in case ascertainment. It was not useful in detecting outbreaks, as the feedback of data was slow.

- **Predictive value positive :** This is the proportion of reported cases who are confirmed to have the disease under surveillance. It reflected the sensitivity and specificity of the case definition and the prevalence of the disease in the population. The predictive value positive of a disease increases with increasing specificity and prevalence. This was 81.4% for tuberculosis in 1970, (1712 cases were reported), whilst in 1985, this was 62% (944 cases were reported).

- **Representativeness :** it was representative, in that it accurately described the occurrence of tuberculosis over a long period of time. It also used population denominators derived from the Australian Bureau of Statistics.

- **Timeliness :** the system was not timely, both in obtaining data and feedback. Reports were only published yearly.

- **Resources used :** the resources used for this surveillance were considerable as during the period of the National Tuberculosis Campaign, a Division existed within the Commonwealth Department of Health in Canberra. for the purposes of administering the programme funds.

With these points in mind, a new system was recommended to be designed for use for the surveillance of tuberculosis. The **Mycobacterial Diseases Database** was designed in 1991 to enhance the surveillance of notified

cases of tuberculosis at the national level. Concerns about the changing trends in tuberculosis overseas have resulted in a resurgence of interest here. In 1990, an agreed format for the transfer of data was agreed by all States and Territories. This was to become the template for the Mycobacterial Database (see attached). The significant difference from the old system was that this system is a record based system. This enabled greater interrogation of the database. This database was then distributed to all States and Territories for data transfer.

2 The ACT Notifiable Diseases Surveillance System

The ACT Notifiable Diseases Surveillance System was also reviewed in 1991, prior to the amendment of the Public Health (Infectious and Notifiable Diseases) Regulations for the ACT. The following summarised the conclusions reached on the current system.

- Data from disease notification were entered into a file in Epi Info. in a timely manner by the Manager of the Communicable and Environmental Disease Control Section.
- Limited analysis was done at the Communicable and Environmental Disease Control Section. No mechanisms existed for the feed back of epidemiological data to the reporting general practitioners.
- There was a need to upgrade the surveillance system for the entering and analysis of data, in line with the expected amendments to the Public Health (Infectious and Notifiable Diseases) Regulations.
- There was a need to identify a mechanism of feedback to the

general practitioners.

- Data were sent to the Communicable Diseases Section of the Commonwealth Department of Health, Housing and Community Services on a fortnightly basis by mail.

In 1991, I designed a new surveillance system for the ACT Board of Health, based on Epi Info programme, and using fields based on the new surveillance forms prepared by the ACT Board of Health. The documentation for this system is attached. This programme was designed to enable automatic coding and report generation of notifiable diseases in the ACT. It also enabled some analysis of the database. Currently, the system is updated weekly and data are transmitted to the Commonwealth Communicable Diseases Section on a fortnightly basis via modem. Feedback to the general practitioners has improved, with occasional updates of outbreak reports in *Canberra Doctor*, a monthly newspaper for medical practitioners of the ACT. A system of faxing results of disease outbreaks to sentinel general practitioners was also introduced.

3 The Australian Tuberculosis Reporting System

Since 1986, the surveillance of drug resistance of the commonly used anti tuberculous drugs had been performed by the Special Interest Group in Mycobacterial, within the Australian Society for Microbiology. The first report was published in the *CDI* in 1989. In 1991, I negotiated for this surveillance system to be brought under the auspices of the CDNA (Communicable Diseases Network - Australia). By the end of 1991, I had drug sensitivity

data for all isolates of *M tuberculosis*, tested in Australia, from 1988 to 1991. The analyse of these data resulted in the presentation to a conference at Sydney. The attachment describes the information collected by this surveillance system to date.

Reference.

(1) Centers for Disease Control. Guidelines for evaluating surveillance systems. MMWR 1988; 37 (suppl. no. S-5) : [inclusive page numbers].

MYCOBACTERIAL DISEASE DATABASE VERSION 2, MAY 1991

Developed by the Communicable Disease Section

Department of Community Services and Health

Canberra, ACT

1. O INTRODUCTION

The Mycobacterial disease database has been developed to monitor Mycobacterial diseases in Australia. This has evolved due to the necessity to develop an improved mechanism for the surveillance of tuberculosis in particular. The first version was trialled using data from the NT and modifications were made subsequent to that.

This database will enable the regular collation, timely analysis and dissemination of national TB data to health authorities, clinicians and health professionals interested in tuberculosis epidemiology. It is expected that feedback regarding this version would enable us to further improve and enhance the database.

2.0 THE CURRENT DATASET (Appendix A)

The current dataset consists of two sections: Core dataset and Supplementary dataset.

Core dataset - consists of ten questions relating to basic characteristics of the patient and information regarding transmission of data to the CDN - A (Communicable Disease Network - Australia). Specific fields are:

- Unique identifier
- Disease
- Post-code of residence
- DOB
- Sex
- Aboriginal
- Date of onset of disease
- Date of report of disease to State/Territory Authority
- Laboratory confirmation or definite clinical diagnosis
- Week of transmission ie week 1 begins on the first Sunday of the year.

(b) **Supplementary dataset** - consists of a further ten questions relating to the characteristics of the disease. Specific fields are:

- Ethnicity
- Country of birth
- Length of stay in Australia
- Pathogens
- Principal site of disease
- Diagnostic method
- Medications used at notification
- Previous BCG vaccination
- HIV status
- Reactivation or relapse status

3.0 DEFINITIONS USED

DISEASE

Disease here is coded as 034 Tuberculosis or 044 Atypical (see Appendix B). Tuberculosis would include M. TB., M. Bovis (not including BCG-Bovis) and M. Africanum. Atypical would include all others (adapted from **"Tuberculosis in Australia and New Zealand into the 1990's" Pg 12).**

TUBERCULOSIS ("ACTIVE" CASE OF TB)

(1) a case which has been confirmed by the identification of M. Tuberculosis culture or by microscopy, or

(11) a case of TB which has been diagnosed to be active clinically and which has been accepted, as such, by the State or Territory Director of TB.

DATE OF ONSET OF DISEASE

The following are acceptable in the order given:

(i) date of first lab. specimen taken

(ii) date the doctor wrote the notification

(iii) date the notification was received

(iv) date of admission to hospital

ETHNICITY

Originating from a specific racial group or a member of an ethnic group.

COUNTRY OF BIRTH

The countries selected are based on those countries reporting an incidence of greater than 10 cases a year (based on 1986/87 data). In this dataset, all the countries are based on **Australian Bureau of Statistics** classification and as such, will have denominators for comparison purposes.

PATHOGENS

As defined by the NHMRC (in **"Tuberculosis in Australia and New Zealand into the 1990's).**

PRINCIPAL SITE OF DISEASE

The predominant site of the disease based on the criteria set by the American Thoracic Society (**Am. Rev. Respir Dis 1990: 142: 727-735**). Other sites may also be listed . Anatomic sites may be specified more precisely.

REACTIVATION (RELAPSE)

A case of active tuberculosis diagnosed again (bacteriologically, radiologically or clinically) following previous full treatment, (as deemed appropriate by the Director of TB) and considered inactive or quiscent.

4.0 OPERATIONAL FEATURES

The Mycobacterial Database has been created using Epi-Info. and has four files.

(a) Epi Info - Epi Info, version 5, is a word processing, database and statistics system developed by the Centers for Disease Control, Atlanta and World Health Organization, Geneva. It is developed primarily for disease surveillance and for epidemiology. It uses an IBM compatible computer and it is Public Domain software. A copy of this program can be obtained through the Communicable Disease Section, should this be necessary.

(b) Mycobacterial Database - The Mycobacterial Database uses Epi Info to input data and to analyse data. It consists of the following files:

- **TB.QES** - is the questionnaire on which the database is based (see Appendix A).
- **TB.REC** - the database itself, in which records are entered.
- **TB.BAK** - backup file.
- **TB.CHK** - the check program which gives additional information and checks the data when input is made.

(c) Loading Mycobacterial Database - Use the ENTER Program in Epi-Info to load TB.REC. The ENTER Program will ask you for the name of the file to be loaded (Make sure that the path to the file is correct). This will result in the database being presented on the screen for data input. For more information about the ENTER Program, refer to the Epi Info Manual (see References).

(d) Data Input - Allowable legal input values associated with the fields will be presented at the bottom of the screen eg.for DISEASE it will be 034, 044.

Pressing the <F9> key will evoke a window for the legal values available.

Selection of the correct code can then be made by pressing the up or down cursor keys.

Entry of the code can then be made by pressing the Return (Enter) key.

On entering the code, the description of the code will be printed on the screen next to the field as a cross

In some fields, the input will result in a jump to the next appropriate field.

eg. in the "ETHNIC" field, a correctly filled value, say 0, will result in skipping the "OTHERS, DESCRIBE" field to the "COUNTRY OF BIRTH" field.

Note also that the Core dataset is presented in one screen and the Supplementary dataset in another.

5.0 CONCLUSION

It is hoped that the reporting of Tuberculosis in Australia will be enhanced by the introduction of this database. However, the continuation of surveillance of this very important disease can only be effective if the many dedicated health professionals and health authorities continue to be involved in this process. For this reason, continued colloboration and cooperation is essential.

Please address your comments to:

Dr David Cheah

Epidemiology Registrar

Communicable Disease Section

Department of Community Service and Health

APPENDIX A

SPECIFIC CODES USED ARE :

Disease	034	TUBERCULOSIS
	044	ATYPICAL

Sex	M	MALE
	F	FEMALE
	U	UNKNOWN

Aboriginal	0	ABORIGINAL
	1	NON-ABOR

Ethnicity	0	ABORIGINAL
	1	ASIAN
	2	CAUCASIAN
	3	PAC. ISLANDER
	4	EUROPEAN
	5	OTHERS
	6	UNKNOWN

Country of birth	01	AUS	11	USSR
	02	CHINA	12	THAILAND
	03	GREECE	13	TIMOR
	04	HONG KONG	14	TURKEY
	05	INDIA	15	UK/IRELAND
	06	INDONESIA	16	VIETNAM
	07	ITALY	17	YUGOSLAVIA
	08	LEBANON	18	OTHERS
	09	NZ	19	UNKNOWN
	10	PHILIPPINES		

Pathogen	01	TUBERCULOSIS
	02	BOVIS
	03	AFRICANUM
	04	KANSASII
	05	XENOPEI
	06	AVIUM/INTRAC.
	07	CHEL/FORT.
	08	OTHERS
	09	UNKNOWN

Principal site of disease	0	PULMONARY
	1	PLEURAL
	2	LYMPHATIC
	3	BONE/JOINT
	4	GEN/URINARY
	5	MILIARY
	6	MENINGEAL
	7	OTHERS
	8	UNKNOWN

Previous BCG vaccination	0	+ve
	1	-ve
	2	UNKNOWN

HIV status	0	+ve
	1	-ve
	2	UNKNOWN

* Note :
In postcode of residence, the range of acceptable postcodes are from 0800 to 7999. Numbers outside this range are not acceptable. No windows are provided.

APPENDIX B

MYCOBACTERIAL DISEASE DATASET: VERSION 2, MAY 1991

CORE DATASET :

1	UNIQUE {ID}ENTIFIER	########
2	{DIS}EASE	__
3	{P}OST{COD}E OF RESIDENCE	####
4	{DOB}	<DD/MM/YY>
5	{SEX}	_
6	{AB}ORIGINAL	_
7	DATE OF {ONSET} OF DISEASE	<DD/MM/YY>
8	DATE OF {REPORT} OF DISEASE TO STATE/TERRITORY AUTHORITY	<DD/MM/YY>
9	LABORATORY {CONF}IRMATION OR DEFINITE CLINICAL DIAGNOSIS	<DD/MM/YY>
10	WEEK OF {TRANS}MISSION, I.E. WEEK 1 BEGINS ON THE FIRST SUNDAY OF THE YEAR	##

SUPPLEMENTARY DATASET next screen.....

SUPPLEMENTARY DATASET:

11	{ETHNIC}ITY	__
	OTHERS, DESCRIBE	_____
12	{C}OUN{TRY} OF {B}IRTH	__
	OTHERS, DESCRIBE	_____

13 LENGTH OF {AUSRTRALIAN {RES}IDENCE IN YEARS ###

14 {PATH}OGEN __

OTHERS, DESCRIBE _____

15 PRINCIPAL {SITE} OF DISEASE __

OTHERS, DESCRIBE _____

16 DIAGNOSTIC METHOD:

{CULT}URE <Y>

{MICRO}SCOPY <Y>

{HISTO}LOGY <Y>

{TUB}ERCULIN {TES}T <Y>

{RADIO}LOGICAL SIGNS <Y>

{CLIN}ICAL SIGNS <Y>

OTHERS, DESCRIBE _____

17 MEDICATIONS AT NOTIFICATION DATE :

{ISO}NIAZID <Y>

{RIF}AMPICIN <Y>

{PYR}AZINAMIDE <Y>

{ETHA}MBUTOL <Y>

{STR}EPTOMYCIN <Y>

{ETH}IONAMIDE <Y>

{PRO}THIONAMIDE <Y>

{CYC}LOSERINE <Y>

OTHERS, DESCRIBE _____

18	PREVIOUS {BCG} VACCINATION	__
19	{HIV} STATUS	__
20	{REACT}IVATION AFTER PREVIOUS FULL TREATMENT	<Y>

REFERENCES

1 National Health and Medical Research Council. **Tuberculosis in Australia and New Zealand into the l990's.** Australian Government Publishing Service. Canberra. 1990.

2 American Thoracic Society. Diagnostic Standards and Classification of Tuberculosis. **American Review of Respiratory Disease.** 1990: 142:725-735.

3 Dean AG, Dean JA, Burton AH, Dicker RC. **Epi Info, Version 5: a word processing, database, and statistics program for epidemiology on microcomputers.** USD, Incorporated, Stone Mountain, Georgia,1990.

ACT NOTIFIABLE DISEASES DATABASE

The ACT Notifiable Diseases Database was created to enhance the surveillance and reporting of notifiable diseases in the ACT. It was created using Epi Info, an epidemiology software package from the Centers for Diseases Control, Atlanta, and is dependent on information provided by the Notifiable Forms currently used by the ACT Board of Health.

1.0 SYSTEM REQUIREMENTS

The program runs on an IBM compatible computer with one floppy drive (A drive) and a hard drive (C drive).

2.0 PROGRAMS IN THE SYSTEM

(1) ACT.QES - the questionnaire on which the database was created. Alterations to the database can be made through this questionnaire (see Appendix A).

(2) ACT.REC - the database file.

(3) ACT. CHK - the file which checks the data being entered.

(4) ACT.PGM - the program which will transfer data to a separate file (COM.REC), which can then be sent to the Commonwealth Department of Health for national surveillance purposes (Note : this also includes the COPY program).

(5) REPC.PGM - the program which will print a report of compulsory notifications for the ACT.

(6) REPV.PGM - the program which will print a report of voluntary

notifications for the ACT.

(7) COPY.PGM - the program which will copy COM.REC to A drive.

3.0 FUNCTIONS

Entering data - Use the ENTER program in Epi Info. Type "A:ACT". Windows (F9 key) are available for the following fields :

Category	Code Source
Disease	Suburb of Doctor
Suburb of Patient	

Options for those fields are entered directly from the windows.

Ordering reports - Reports are ordered on a periodic basis by using the following programs :

REPC.PGM - In the ANALYSIS program of Epi Info, type **"READ A:ACT"** making sure that the path is correct. Then type **"RUN REPC.PGM"**. A prompt asking for the beginning and ending date will appear. Entering these dates and pressing Return will start the program which prints a list of compulsory notifications for the ACT, frequency of disease reported and sources of the reports.

REPV.PGM - In the ANALYSIS program of Epi Info, type **"READ A:ACT"** making sure that the path is correct. Then type **"RUN REPV.PGM"**. A prompt will appear asking for the beginning and ending date. Entering these dates and pressing Return will start the program which prints a list of

voluntary notifications for the ACT, frequency of the diseases reported and sources of the reports.

Transferring data for the Commonwealth - In the ANALYSIS program of Epi Info, type **"READ A:ACT"** making sure that the path is correct. Then type **"RUN ACT.PGM"**. A prompt will appear asking for the beginning and ending date. Entering these dates will start the program which creates a file in C:\TEMP subdirectory called COM.REC in the format of the Commonwealth system and which can then be copied onto a floppy in the A drive for transfer to the Communicable Diseases Section in the Commonwealth Department of Health.

Copying COM.REC to A drive - In the ANALYSIS program of Epi Info, type **"RUN COPY.PGM"** making sure that the path to the COPY program is correct. A prompt will appear asking for a formatted disk to be placed in A drive before continuing. On pressing Return on the keyboard, the operations of copying COM.REC to A drive will occur before returning to the Epi Info program.

4.0 ACKNOWLEDGMENTS/HELP

Extensive consultations were made with Dr Tony Watson, NCEPH Epidemiology Registrar, Hobart, Tasmania. Thanks to David Evans for the programming part. Direct help can be sought through the Communicable Diseases Section by calling myself or David Evans on (06) 2897155.

Dr David Cheah

NCEPH Epidemiology Registrar

Communicable Diseases Section

Communicable Disease and International Health Branch

15 October 1991.

APPENDIX A

ACT COMMUNICABLE DISEASE SURVEILLANCE

{Id}entifier <idnum> {Cat}egory _ {Conf}irmation <Y>

Disease <A > {Dis}ease code ###

{O}ther {Dis}ease <A >

{Sub}urb of {pat}ient _____ {P}ost {cod}e _____

{DOB} <dd/mm/yy> {Age} ## {Sex} <A> {Ab}original <A>

{Onset} date <dd/mm/yy> {Report} date <dd/mm/yy>

{Occ}upation _____ Place of {work} _____

Suspected {origin} of disease _____

Public health {action} _____

{C}ode {source} _ {Source} _____ {Others} _____

{Name} of {Dr} _____

{Add}ress of {Dr} _____

{Sub}urb of {Dr} _____ {Post}code {Dr} ____

{Trans}mit week ##

Notes on the data provided by the SIG in Mycobacteria

The Australian Tuberculosis Reporting System is a joint project between the Commonwealth Department of Health, Housing and Community Services and the Special Interest Group in Mycobacteria, for the surveillance of drug resistance in tuberculosis isolates tested in Australia. Data is collected and compiled by members of the SIG in Mycobacteria and sent to the Communicable Diseases Section on a yearly basis. These data are entered into an Epi Info file and analysed. A case is included in the database if it has been shown to be culture positive by one the five TB Reference Laboratories in Australia. Epidemiological data is available to all on request to the Director of Communicable Diseases Section.

* The data for 1989 has been provided by David Dawson in Dbase format. This was converted to Epi Info format.
* As for as possible data had been analysed with consistency and comparability in mind.
* The "newer" dataset of 1991 has the potential to analyse for species of organisms isolated, eg M Tb, M bovis or BCG-Bovis.

David Cheah

Epidemiology Registrar

Communicable Diseases Section

Ph (06) 289 8416

Australian Tuberculosis Reporting Scheme
Mycobacterium tuberculosis Complex

State Reference Lab [ ]

Reporting Period [/ /] to [/ /]

No.	Lab Reference Number	Patient					Specimen			Species Isolate		Drug Profile (R,S,U) (Resistance, Sensitive, Unknown)									Office use only
		Identifier	Sex (*m,f,u*)	Year of Birth	HIV (*y,n,u*)	State of residence	Source(s)	Office code	Date Collected	Species	Office code	S	H	R	E	Z					

Lab contact person: [ ] Phone No: [ ]

A joint project of The Commonwealth Department of Health, Housing and Community Services and the Australian Society for Microbiology (SIG in Mycobacteria).

SECTION 6

SECTION 6 SUMMARY OF PRACTICAL EPIDEMIOLOGICAL EXPERIENCE GAINED

During the course of the MAE programme, I gained the following experiences in applied epidemiology.

1 Field experience in outbreak investigations.

I was involved in several outbreaks, including a gastroenteritis outbreak, a measles outbreak, a rubella outbreak and other minor outbreaks. Three of these outbreaks were written up in the CDI (see Section 2). In the gastroenteritis outbreak, I was involved in identifying the outbreak. In the measles outbreak, I understood the importance of diplomacy in dealing with school authorities, especially in trying to obtain school records. There was a need for continued dialogue between the Health Department and affected schools in control measures. Often, there were diplomatic issues in studying the outbreak as well as in controlling the outbreak.

In the rubella outbreak, I instigated the serological confirmation of this disease in Canberra. This outbreak was detected because of good communications between schools and the ACT Board of Health, established during the measles outbreak of 1991.

2 The coordination of public health responses during an outbreak.

In the various outbreaks mentioned, I liaised with the Chief Health Officer of the ACT, in the coordination of a public health response. In

the rubella outbreak, this involved communicating with general practitioners and organising a fact sheet for schools, whilst the Chief Health Officer managed the media releases. In the measles outbreak, I wrote a fact sheet for school principals, spoke to students in Lyneham High School and wrote an article in the *Canberra Doctor* about the outbreak. The option of organising a catch up vaccination programme was also considered. I found that networking with medical practitioners at a "hands-on" level helped in the coordination of a public health response. My personal contacts with the staff at the Calvary Hospital was also valuable in identifying this outbreak.

3 **Designing a practical surveillance system for use in public health, both in a regional setting and in the national perspective.**

I reviewed the notifiable disease surveillance system for the ACT as well as designed a new programme for disease surveillance for the Communicable and Environmental Disease Control Section of the ACT (see Section 5). I also designed the National Tuberculosis Surveillance system for the notification of new cases and for the monitoring of drug resistance. In doing so I gained experience in using the Epi Info programme.

4 **Coordination of a national public health working party.**

Working as the Secretary of the Tuberculosis Working Party gave me the opportunity to coordinate the activities of a specialist group formed

under the auspices of the National Health and Medical Research Council. Included within this working party are medical specialists and public health professionals. The collation of data, the setting up of a teleconference and the final writing up a report are just part of my responsibilities. I have enjoyed working within this group and have gained insights into the organisational aspects of coordinating such a group. I have also learnt about tact and diplomacy in dealing with these eminent scholars.

5 **Communicating results to public health personnel and the public.**

I gained experience in giving public health information to medical practitioners as well as to the public when I took calls about travel enquires. I learnt how to organise and present public health data in peer reviewed journals. My experience in the Communicable Diseases Section was valuable in understanding the needs of public health practitioners.

6 **Experience in writing reports and presenting data in a conference.**

I gained experience in writing reports to the *CDI* following field investigations (see Section 2) as well as in oral presentations in conferences (see Section 3).

7 **Experience in a Commonwealth bureaucracy.**

The working experience in a Commonwealth bureaucracy has been beneficial for me. I gained insights in public health policy making, Federal organisational structures of health administration and liaison experience with State and Territory Departments of Health. I was also privileged to be involved in a Working Party, under the auspices of the NHMRC.

8 **Independent research**

The multi tasking nature of the Commonwealth Department work environment enables one to independent and creative in dealing with projects. I gained experience in working with personal computers, searching for literature with Medline and associated database and networking with other professionals and organisations (eg computer specialists and the Australian Bureau of Statistics).

SECTION 7

SECTION 7 ONGOING AND CURRENT PROJECTS

1 A Study into Suicides in the ACT, 1983 to 1992.

In December 1991, I met Dr Alan Cala, the Anatomical Pathology Registrar at Woden Valley Hospital. We commenced a study into "successful suicides" in the ACT between 1983 and 1992. The purposes of this study are :

a to identify the modalities of suicide, between 1983 to 1992.

b to identify the sex specific rates and age specific rates of suicide.

c to compare the rates of suicide between males and females between the first five years of the study and the second five years of the study.

d to identify the method of suicide specific for males and females and the relative risk of the methods.

A successful suicide is defined as a case of "death by own hands" as deemed by the Coroner of the ACT in the process of identifying the cause of death in a person. No motives are considered as part of the case definition. Data were obtained from the Woden Valley Hospital Department of Anatomical Pathology and the Coroners Office, ACT. Population denominators were obtained from the Australian Bureau of Statistics and statistical calculation were performed in Epi Info version 5. This study is currently being analysed and written up for a peer reviewed journal.

2 An evaluation of migrant screening processes for tuberculosis, 1991.

The Tuberculosis Working Party supported a study on the evaluation of migrant screening for tuberculosis in Australia. The attachment describes the study objectives. To date, data had been received from all States and Territories, except the ACT. This study is currently being analysed and written up.

3 Drug resistance patterns for anti tuberculous drugs in Australia, 1989 - 1991.

Data submitted by the Special Interest Group for Mycobacteria, is currently being analysed and written up. The attachment describes the data available to date.

4 M Bovis survey in Australia, 1983 - 1992.

In 1991, the Communicable Diseases Section was asked to respond to an inquiry by Dr Ann Fanning from the Department of Medicine at the University of Alberta, Edmonton, about M Bovis disease in Australia. I undertook to conduct a survey to identify the characteristics of M Bovis between 1983 and 1992. Data were obtained from the Tuberculosis Reference Laboratories and is currently being collated. This study should conclude in 1993. The attachment describes the data being sought.

EVALUATION OF OUTCOMES OF SCREENING AND MANAGEMENT OF M TB FOR FOREIGN BORN AUSTRALIANS

1 BACKGROUND

Tuberculosis (Tb) remains a public health concern in Australia, with about nine hundred new cases notified each year. Of these, more than 65% are foreign born, with the majority of cases from South East Asia. More than 40% of cases were identified within five years of assuming residence in Australia. Before a migrant or refugee is allowed into Australia, a screening procedure for Tb is undertaken. The TBU or TB Undertaking is an undertaking in which a new immigrant agrees to contact the State/Territory Health Department within a specified time after arrival in Australia, to be followed up for Tb. The TBU is not compulsory and is not enforceable by law. It is now necessary to evaluate the effectiveness of the TBU in identifying cases of Tb in immigrants before their arrival in Australia.

2 DESIGN OF STUDY

The effectiveness of the TBU system will be evaluated by its ability to identify new cases of Tb in persons before their arrival in Australia and placing these individuals under surveillance upon arrival. This study will be a retrospective cohort study. Information about of all new cases of Tb in foreign born Australians, notified in 1991, will be sought from the State/Territory Health Departments. Records of these individuals will be reviewed at the Chest Clinics where they were first identified, using a standardised questionnaire (Attached), by public health personnel. Missing data will be sought, as far as practical, by contacting the cases themselves. Collated data will then be analysed in the Communicable Diseases Section, Woden, Canberra. Identifiers will be stripped at the State/Territory level before the data are transferred for analysis.

3 SPECIFIC OBJECTIVES OF STUDY

The study will answer the following questions in foreign born notifications.

(1) To determine the visa status of new cases.

(2) To determine the proportion of new cases who have a TBU.

(3) To determine the proportion of new cases who were diagnosed overseas and in Australia.

(4) To determine the adequacy of documentation from DILGEA to the respective Chest Clinics.

(5) To determine the source of referrals of new cases.

(6) To determine the proportion of missed cases in relation to Tb screening process.

(7) To determine the outcomes of Chest Clinic attendances by documenting :

* treatment outcomes
* follow up
* compliance with follow up appointments

AN EVALUATION OF SCREENING PROCEDURES IN FOREIGN BORN TB
A Study Undertaken by the TB Working Party
August 1992

Chest Clinic :

State :

Date of data collection :

A PERSONAL DETAILS *(Circle or answer questions)*

1 Patient ID No :

2 Postcode :

3 Sex :

4 Date of birth : or Age at first appointment (yrs) :

5 Country of birth :

6 Date of arrival in Australia :

7 Length of time in Australia when TB was diagnosed (months/years) :

8 (a) Country of most recent residence before arrival in Australia :

(b) Time spent in this country before arriving in Australia (months/years) :

B SCREENING/IMMIGRATION DETAILS *(Circle or answer questions)*

9 Was patient screened in home country before arriving in Australia?

Yes No

10 Country where screening was done :

11 Screening organisation :

(a) International (IOM)

(b) Australian Government (or Panel Doctors)

(c) others, describe _____

12 Is patient on TBU ?

Yes No

13 Was full documentation available from DILGEA when patient first attended the Chest Clinic, so as to enable a decision regarding further management ?

Yes No

14 Visa status of patient at first appointment (if known) :

a Migrants/Refugees

b Temporary Resident

c Students

d Visitor

e Permanent Resident

f Not known

g Others, describe _____

C CLINICAL DETAILS AT FIRST APPOINTMENT *(Circle or answer questions)*

15 Who referred the patient to the Chest Clinic ?

a Self, as part of TBU

b Self, but not as part of TBU

c Referred by another clinician

d referred by a non clinician, other than self, describe who : _____

e as part of assessment prior to change in visa status

f contact of new case

g others, describe _____

16 Date of first clinic attendance :

17 Date of last attendance :

18 Date of TB diagnosis, if available :

19 Date of notification, if available :

20 Diagnosis at first attendance :

a new case of TB, as deemed by the Chest Clinic Physician

b old TB, for follow up

c relapse of old TB, having had previous full treatment

d relapse of old TB, having had previous incomplete or impartial treatment overseas

e diagnosis other than TB

f others, describe _____

21 (a) Was diagnosis changed during the Chest Clinic appointments ?

Yes No

(b) New diagnosis is :

D OUTCOMES AFTER INITIAL APPOINTMENT *(Circle or answer questions)*

22 Outcomes of Chest Clinic appointments :

a finished full course of prescribed treatment

b continuing treatment in the same Clinic

c interrupted course (> 1 month), due to patient non compliance

d died during treatment

e discharged to the care of another clinic/doctor/health institution.

f placed of prophylaxis only.

g others, describe _____

23 Was therapy supervised ? (observed by another person)

Yes No

24 Number of times seen at the Chest Clinic in total (including the first appointment) :

25 Number of appointments missed by the patient :

26 After non attendance, did the community nurse actively seek (at least once), the patient to attend the clinic ?

Yes No

27 Other comments about the case :

_____

CULTURE POSITIVE TUBERCUOSIS IN AUSTRALIA, 1989 - 1991
Results of analysis from data supplied by the SIG in Mycobacteria

(1) Number of isolates and rate of culture positive tuberculosis

	1989	1990	1991
NSW	247	275	248
QLD	68	77	90
SA	80	41	36
VIC	162	206	222
WA	53	47	54
TOTAL	610	646	650
Rate*	3.6	3.8	3.7

* rate per 100,000 per year, based on the mid year population supplied by the Australian Bureau of Statistics

(2) Gender of patients tested

	1989	1990	1991
Female	240	250	259
Male	330	365	360
Unknown	40	31	31
Total	610	646	650

(3) Sites of isolates tested

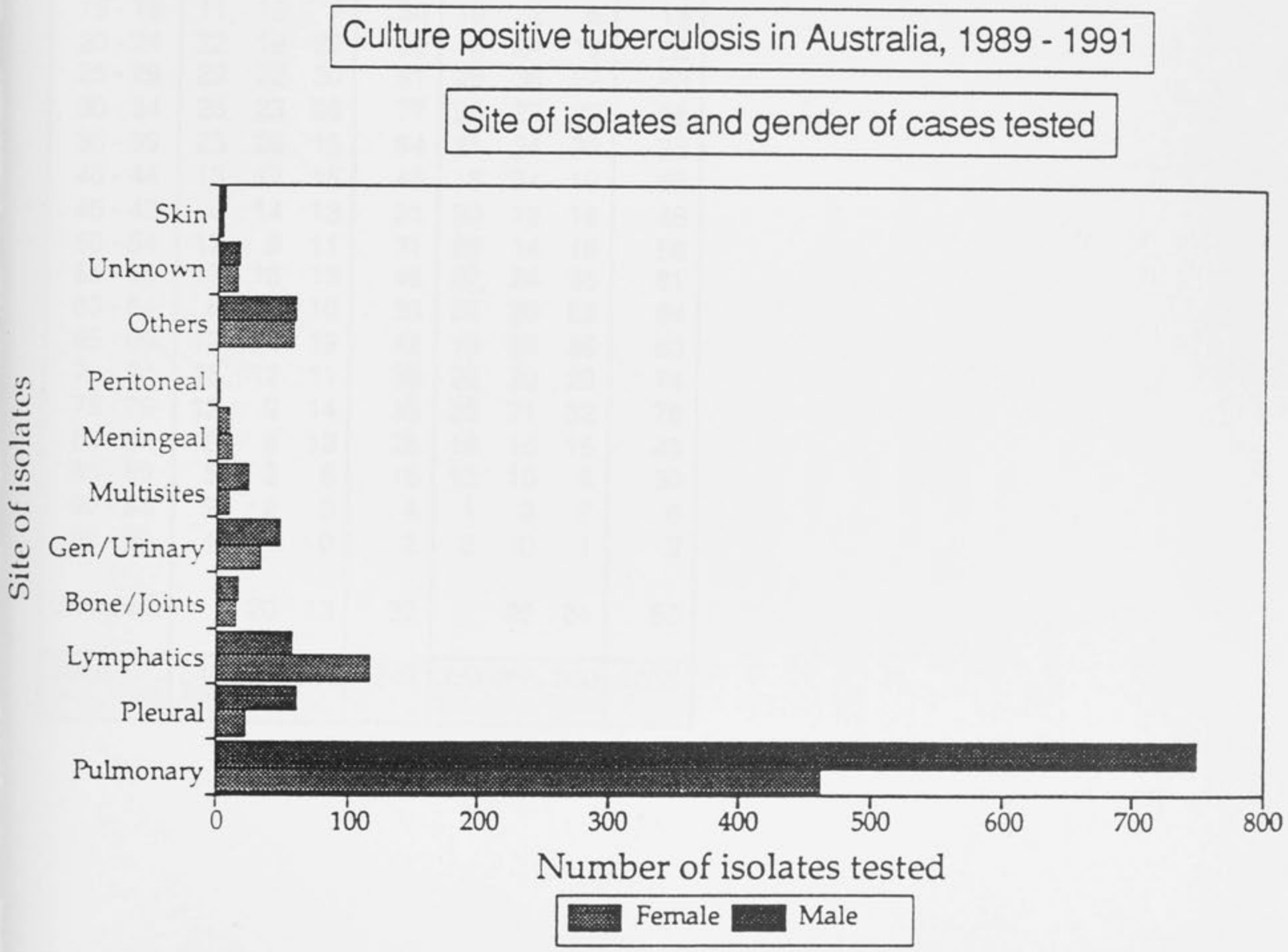
	1989	1990	1991
Pulmonary	430	444	401
Pleural	26	33	31
Lymphatic	53	62	74
Bone/Joint	8	12	15
Gen/Urinary	26	27	35
Multiple	10	9	15
Meningeal	2	11	8
Peritoneal	1	0	3
Others	45	32	47
Unknown	9	16	10
Skin			11
Total	610	646	650

CULTURE POSITIVE TUBERCULOSIS IN AUSTRALIA, 1989 - 1991

(4) Site of isolates and sex of cases tested

	FEMALES				MALES			
Site	89	90	91	Total	89	90	91	Total
Pulmonary	155	154	151	460	246	269	233	748
Pleural	8	7	7	22	17	24	21	62
Lymphatics	38	34	45	117	13	24	21	58
Bone/Joints	6	6	4	16	2	6	9	17
Gen/Urinary	8	13	13	34	16	12	21	49
Multisites	4	3	2	9	5	6	13	24
Meningeal	0	8	3	11	2	3	5	10
Peritoneal	0	0	2	2	0	0	1	1
Others	16	17	25	58	26	14	20	60
Unknown	5	8	2	15	3	7	8	18
Skin			5	5			6	6
Total	240	250	259	749	330	365	358	1053

* 1989 - 570 of 610 cases had data on site and sex
* 1990 - 615 of 646 cases had data on site and sex
* 1991 - 619 of 650 cases had data on site and sex


Culture positive tuberculosis in Australia, 1989 - 1991
Site of isolates and gender of cases tested
Site of isolates
Skin
Unknown
Others
Peritoneal
Meningeal
Multisites
Gen/Urinary
Bone/Joints
Lymphatics
Pleural
Pulmonary
0
100
200
300
400
500
600
700
800
Number of isolates tested
Female
Male

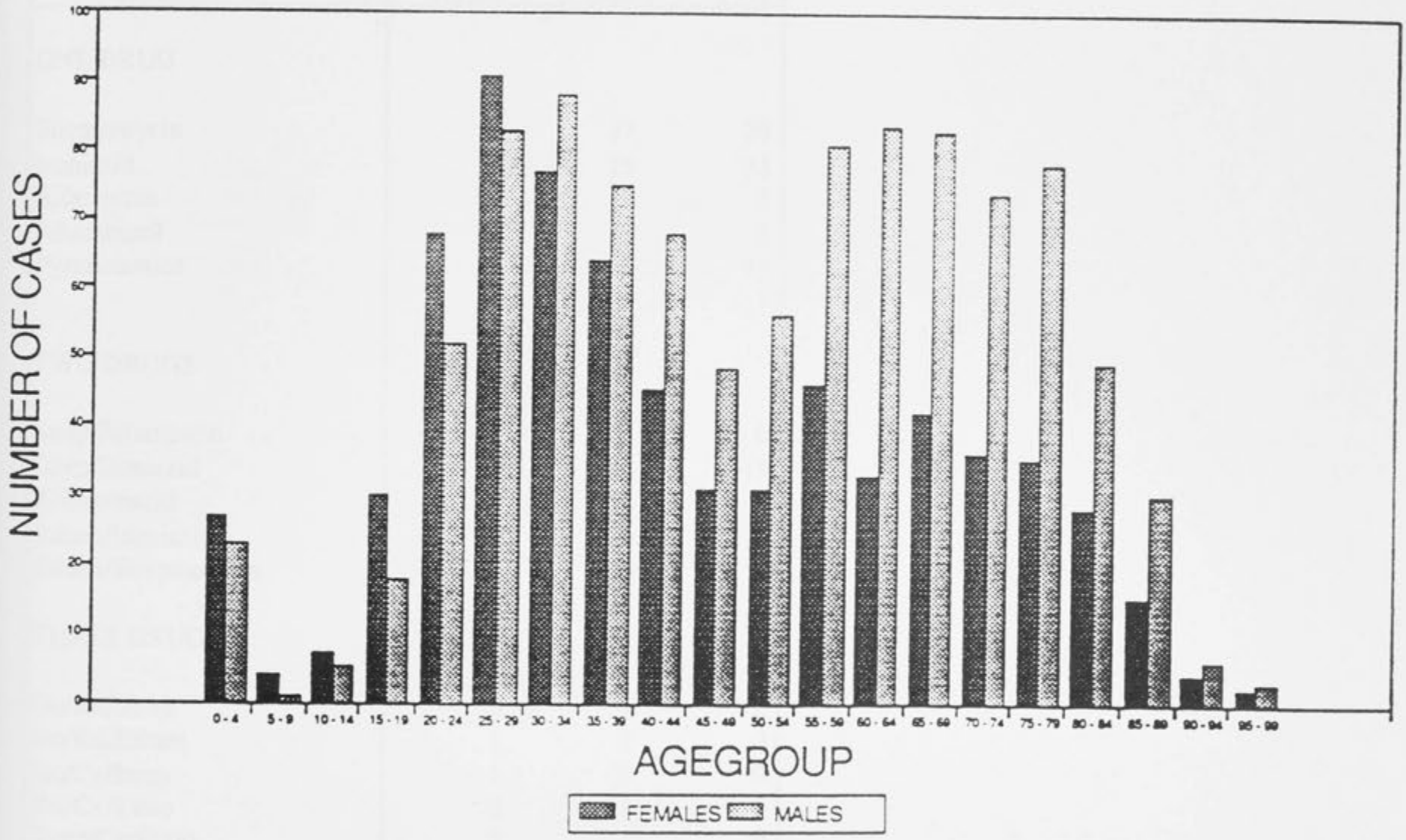
CULTURE POSITIVE TUBERCULOSIS IN AUSTRALIA, 1989 -

(5) Isolates by age and sex of cases

	Females				Males			
Agegroup	89	90	91	Total	89	90	91	Total
0 - 4	17	2	8	27	14	3	6	23
5 - 9	2	0	2	4	0	0	1	1
10 - 14	2	3	2	7	1	2	2	5
15 - 19	11	12	7	30	10	2	6	18
20 - 24	22	19	27	68	15	24	13	52
25 - 29	29	32	30	91	25	36	22	83
30 - 34	26	23	28	77	29	27	32	88
35 - 39	23	26	15	64	21	34	20	75
40 - 44	13	17	15	45	15	34	19	68
45 - 49	4	14	13	31	20	12	16	48
50 - 54	12	8	11	31	26	14	16	56
55 - 59	17	16	13	46	22	24	35	81
60 - 64	8	15	10	33	28	30	26	84
65 - 69	12	11	19	42	19	28	36	83
70 - 74	13	12	11	36	26	20	28	74
75 - 79	12	9	14	35	25	21	32	78
80 - 84	9	6	13	28	19	15	15	49
85 - 89	5	2	8	15	12	10	8	30
90 - 94	2	2	0	4	1	3	2	6
95 - 99	1	1	0	2	2	0	1	3
Unknown		20	13	33		26	24	50
Total	240	250	259	749	330	365	360	1055

Culture positive tuberculosis in Australia, 1989 - 1991

Isolates by age and sex of cases



CULTURE POSITIVE TUBERCULOSIS IN AUSTRALIA, 1989 - 1991

(6) Species of isolates tested in 1991

SPECIES	NO
M Tb	629
M bovis	4
BCG-BOVIS	17
Total	650

(7) Drug resistance patterns, 1989 - 1991

DRUGS	1989	1990	1991
ONE DRUG			
Streptomycin	37	37	26
Isoniazid	29	25	33
Rifampicin	8	12	3
Ethambutol	1	2	1
Pyrazinamide	1	0	17
TWO DRUGS			
Strep/Rifampicin	0	2	0
Strep/Isoniazid	23	14	15
Rif/Isoniazid	2	3	4
Etham/Isoniazid	1	0	0
Etham/Streptomycin	1	0	0
THREE DRUGS			
Iso/Rif/Strep	0	4	2
Iso/Rif/Etham	1	2	0
Iso/Cy/Strep	1	0	0
Rif/Cy/Ethio	0	1	0
Strep/Cy/Ethio	0	1	0
FOUR DRUGS			
Iso/Strep/Etham/Cy	1	0	0
Strep/Iso/Etham/Rif	0	1	0
FIVE DRUGS			
Strep/Iso Etham/Rif/Pyr	0	1	1

CULTURE POSITIVE TUBERCULOSIS IN AUSTRALIA, 1989 - 199

(8) Drug resistance patterns, 1989 - 1991

1989 Number of isolates Total tested = 610

Drugs	By itself	And in combination
Streptomycin	37	64
Isoniazid	29	59
Rifampicin	8	12
Ethambutol	1	5
Pyrazinamide	1	0

1990 Number of isolates Total tested = 646

Drugs	By itself	And in combination
Streptomycin	37	60
Isoniazid	25	50
Rifampicin	12	26
Ethambutol	2	6
Pyrazinamide	0	0

1991 Number of isolates Total tested = 650

Drugs	By itself	And in combination
Streptomycin	26	44
Isoniazid	33	55
Rifampicin	3	10
Ethambutol	1	2
Pyrazinamide	17	18

A SURVEY OF M BOVIS IN AUSTRALIA, 1982 - 1991

STATE :

(A) M BOVIS RELATIVE TO M TB

YEAR	M TB	M BOVIS	TOTAL	% M TB
1991				
1990				
1989				
1988				
1987				
1986				
1985				
1984				
1983				
1982				

A SURVEY OF M BOVIS IN AUSTRALIA 1982 - 1991

(B) SUPPLY DATA ON EACH CASE

YEAR :
CASE NO :
SEX :
AGE OF PATIENT :
OCCUPATION :

POSTCODE :
STATE OF RESIDENCE :

SITE/SITES OF INFECTION (DESCRIBE) :

ADDITIONAL COMMENTS :

A SURVEY OF M BOVIS IN AUSTRALIA, 1982 - 1991

1 {STATE} <A > {YEAR} <A >

2 {SEX} <A> {AGE} ### yr old

3 {OCCUP}ATION <A >

4 {PCOD}E ####

5 {STATE RES}IDENCE <A >

6 {SPEC}IMEN <A > {SITE} <A
>

7 {COMMENTS} <A >

8 {EX}POSED TO {ANIM}ALS <A> Y/N/U

IF SO, WHAT {ANIM}ALS <A >

SECTION 8

SECTION 8 MISCELLANEOUS ACTIVITIES/REPORTS

This section describes other activities which are inherent in my position as Epidemiology Registrar for the Communicable Diseases Section.

(a) Part of my responsibilities involve coordination of the TB Working Party. The TB Working Party was formed under the auspices of the National Health and Medical Research Council, in the 1991 - 1993 triennium, to consider the issues of tuberculosis control in Australia. The terms of reference of this panel are :

1 To develop a national draft action plan for tuberculosis control.

2 To advise and report on proposals for implementation of such a strategy.

3 To report to the Communicable Diseases Standing Committee.

This Panel met by teleconference as well as in person, culminating in the drafting of the Tuberculosis control document in December, 1992. As Secretary of the TB Working Party, I collated papers from the members and wrote some parts of this document (see attachment).

"Controlling Tuberculosis in Australia " a draft report of the Tuberculosis Working Party, NHMRC, submitted to the CDSC, December, 1992.

(b) I was also the liaison person in relation to data required by the World Health Organization. Between 1991/1992, I completed three national surveys to obtain data for the WHO. These are attached.

(1) National Tuberculosis Control Programme Database.

(2) Proforma for Mutual Assistance Programme.

(3) Questionnaire on anti tuberculosis drug supply.

(c) Tuberculosis Data - 1990.

This is presented as an example of my analysis of previously available data on tuberculosis. Analysis on data available to the Commonwealth Department of Health ceased after 1985, when the last published data on TB was available. Collection of TB data ceased after 1987, although some States continued to send regional data until 1988. To ascertain the epidemiology of TB between 1986 and 1990, I undertook a survey of morbidity data from all States and Territories, using previously available TB Notification forms. These data became available by September 1991, except NSW. Final national analysis was delayed until data from NSW became available. Thus, by late 1991, Tuberculosis statistics were eventually published for the years, 1986 to 1990.

CONTROLLING TUBERCULOSIS IN AUSTRALIA

Tuberculosis Control Working Party, NHMRC
December 1992

CONTENTS

List of abbreviations

LIST OF ABBREVIATIONS

ABS	Australian Bureau of Statistics
AFB	Acid Fast Bacilli
AIDS	Acquired Immunodeficiency Syndrome
BCG	Bacille-Calmette-Guerin vaccination
CDSC	Communicable Disease Standing Committee
HIV	Human Immunodeficiency Virus
NHMRC	National Health and Medical Research Council
TB	Tuberculosis disease
TBUs	Signed Health Undertakings
TSANZ	Thoracic Society of Australia and New Zealand
WHO	World Health Organization

A significant part of this document is based on the NSW document "Controlling Tuberculosis in New South Wales." The Department of Health and the authors of this document are gratefully acknowledged.

INTRODUCTION

Controlling tuberculosis in a country has two impacts. It leads to reduction of human suffering from tuberculosis and it leads to the reduction of the transmission of tuberculosis within the community. Many countries, including Australia, have noted a steady decline in the incidence of tuberculosis during this century due to the use of effective chemotherapeutic agents. Currently, the prevalence of tuberculosis is low and developing strategies aimed at the elimination of tuberculosis is a possibility. However, total eradication of tuberculosis is unlikely due to the nature of the disease. It is proposed that intermediate targets are achievable along the path of total elimination.

Tuberculosis is increasing in many countries throughout the world. This has been particularly well-documented in the United States of America but has also been noted elsewhere. In Australia, there has been no increase in the number of people with tuberculosis although the rate of decline in the number may have slowed in the last decade. In the United States the increase is thought to be due to a combination of migration patterns, the association between HIV infection and tuberculosis, and the emergence of drug resistant strains of the organism.

More detailed information about the epidemiology of tuberculosis in Australia is presented later in this document. The main epidemiological features of tuberculosis in Australia are that there are about 900 cases notified to health authorities per annum; of these approximately two-thirds are pulmonary tuberculosis. Seventy five percent of all tuberculosis notifications are confirmed by culture. In 1991, 66% of all cases were born overseas. Of these, 19% occurred less than 1 year after arrival in Australia, and a further 26% between 1 and less than 5 years after arrival; 55% of overseas born cases were notified 5 or more years after arrival.

Clearly, in order to decrease the amount of tuberculosis in the Australian community it is essential that great emphasis be placed on case identification and treatment, and appropriate identification and treatment of contacts. However despite these measures cases of tuberculosis will still continue to occur in those people who have been infected many years before. The most identifiable of these groups are overseas born people. The knowledge that this group represents two thirds of all diagnoses, plus the fact that about 80% are not diagnosed until after they have been in the country for at least one year indicates that our current screening and treatment policies will not make any difference to the rate of tuberculosis occurrence in the future. Indeed, as the immigrant population, known to have high rates of infection, ages, it is likely that the rates will increase. It is only with appropriate screening and preventive therapy that the rates may be expected to decrease.

In 1991, following a request from the Communicable Disease Standing Committee, the National Health & Medical Research Council formed the Tuberculosis Control Working Party. This Working Party was asked to :

1. Develop a national draft action plan for tuberculosis control.

2 Advise and report on proposals for implementation of such a strategy.

3 Report to the Communicable Diseases Standing Committee.

This document will consider tuberculosis from an epidemiological perspective, delineate the goals and targets of a national tuberculosis program, specify the roles of state/territory and commonwealth, and then consider more specific strategies.

Definitions

Currently the overall incidence of sputum smear positive tuberculosis in Australia is around 4 per 100,000 per year. Changes to the microenvironment has resulted in Australia being in an "advanced" stage of tuberculosis control. An "annual risk of infection" survey could accurately monitor tuberculosis control but the interpretation of the result may be difficult because of the cross reactivity from other mycobacteria. Morbidity data are a substitute for the monitoring of tuberculosis control in a community and steps should be in place to ensure the notifications of tuberculosis are complete. Based on the natural history of tuberculosis, the following definitions of the intermediate goals of tuberculosis control are based on **smear positive** tuberculosis.

A "**Close to eradication**" - is the incidence of sputum smear positive pulmonary tuberculosis of less than 1 per 1,000,000 population per year. This is equivalent to a prevalence of tuberculosis infection of less than 1% in the general population with a risk of new infection of less than 0.002% per year.

B "**Virtual eradication**" - is the incidence of sputum smear positive pulmonary tuberculosis of less than 1 per 10,000,000 population per year. This is equivalent to a prevalence of tuberculosis infection of less than 0.1% in the general population with a risk of new infection being less than 0.0002% per year.

The document will consider control in the areas of disease containment, case prevention, disease surveillance and program evaluation.

Disease containment

Early identification and adequate treatment of cases of infectious tuberculosis are the most important measures in prevention of spread. The major obstacle to disease containment is the interruption of and/ or failure to complete therapy with an appropriate drug regimen. The two main causes of treatment failure are inappropriate combinations of medical patient drugs and dosages, and poor compliance (due to inadequate supervision or communication and social or medical host factors such as alcohol, drugs, poor nutrition, homelessness), diabets and immunosuppression.

Case prevention

The main case prevention strategy is screening for, and treatment of, tuberculosis infection in high risk groups. No matter how efficient case finding, diagnosis and treatment are, the development of disease in those already infected can only be prevented by chemoprophylaxis. The associated risks, side-effects and possible emergence of drug resistant strains must be weighed against the potential benefits.

Surveillance

Timely identification and notification of confirmed and suspected cases facilitates early treatment and preventive intervention. Surveillance is essential for determining incidence, distribution and trends of disease and infection and for planning services rationally. In low incidence countries, the risk of infection in the population is the most sensitive parameter of the epidemiology of TB; however as large sample sizes are needed to provide reliable estimates, infection surveillance requires careful strategic planning of screening in high risk populations.

Program evaluation

The monitoring of parameters related to disease containment, case prevention and surveillance activities provides important information for:

- evaluating program performance
- assessing epidemiological trends: eg the incidence of Mantoux conversion in contacts reflects the rate of transmission of TB in the population.
- evaluating the effectiveness of interventions: eg although the efficacy of modern treatment regimens under controlled trial conditions is well established, there are few data available on the effectiveness and efficiency of treatment under routine conditions in low incidence countries.
- program planning: program evaluation, research and monitoring of epidemiological trends should guide program planning, eg screening programs should be regularly evaluated to assess their worth, as screening is generally recommended only where the rate of infection is greater than one per cent .
- patient management: in the case of TB few data beyond those necessary for patient management are required for routine program evaluation.

The rationale behind the proposed policies is that more effective and efficient use of existing prevention and control methods and technologies should lead to significant improvements in TB control. The development of new prevention, diagnostic and treatment technologies will expedite these improvements. Although not specifically addressed by this document, the commonwealth, States and Territories should encourage the development, evaluation and implementation of rapid diagnostic techniques, improved screening methods, short duration drug regimens and treatments for drug resistant strains. This research should be undertaken in cooperation with the National Health and Medical Research Council (NHMRC) and World Health Organization (WHO) sponsored programs.

Monitoring of trends

A good tuberculosis control program shows an annual reduction of new cases of about 10%. In Australia, some States have achieved the intermediate goal of the United States of an incidence of 3 per 100,000 per year. It should be the expected aim of most States/Territories in Australia to register a notification rate of less than 3 per 100,000 by the year 2000. It is essential that different strategies be devised for Aboriginal Australians, other Australian born and immigrants populations. The following goals are recommended for Australia.

GOALS AND TARGETS

GOAL

By 2001

*To reduce the incidence of active TB disease to 1 per 100,000 population.

It is recognised that those at risk of TB in Australia come from two main categories; those at high risk and those at low risk, and that different strategies will be necessary for each group.

TARGETS

Case prevention

By 1995

* To reduce the annual incidence of smear positive TB to 1 per 100,000 population.
* To ensure that 95% of close contacts of smear positive cases are examined within seven days of diagnosis for child contacts and ten days of diagnosis for adult contacts.
* To obtain estimates of infection and disease rates in all potentially high risk population groups.
* To screen new immigrants from high risk countries, and, where appropriate, to prescribe chemoprophylaxis.
* To ensure that 90% of infected people commenced on chemoprophylaxis have taken the drug(s) continuously for the first six months of treatment.

Disease containment

By 1995:

* To detect 90% of all smear positive cases.
* To ensure all smear positive cases are commenced on an appropriate multi-drug regimen.
* To ensure that 90% of all smear positive cases have taken chemotherapy continuously for the first six months of treatment.
* To ensure that 95% of smear positive cases complete chemotherapy within 12 months.

By 2001:

* To detect 95% of all smear positive cases.
* To cure 99% of all smear positive cases.

ROLES OF THE COMMONWEALTH, STATES & TERRITORIES

THE COMMONWEALTH

Surveillance of disease at a national level

Under the auspices of the Communicable Disease Network of Australia and New Zealand, and with the agreement of all States and Territories the details of all new cases of tuberculosis are notified to the Commonwealth Department of Health, Housing & Community Services. The Commonwealth collates, analyses and reports the summary data. As well, the Commonwealth conjointly with the Australian Tuberculosis Reference Laboratories conducts surveillance for anti-tuberculosis drug resistance via the Tuberculosis Reporting Scheme. Results of both surveillance systems are published in Communicable Disease Intelligence.

The Role of the Commonwealth

A National Tuberculosis Program Evaluation and Standards Development

Tuberculosis program evaluation is carried out at the national level by incorporating details from the active disease surveillance system. States and Territory Health Departments are asked, on a yearly basis , to provide data on the outcome of the previous year's cases. A cure rate, or rate of completion of prescribed therapy of 90% fulfills the WHO's criteria for developed countries. The Commonwealth has the responsibility of developing standards of health care practice. The development of standards in laboratory testing and successful outcomes of treatment are some examples. These standards are developed in conjunction with the relevant medical and professional specialist groups, through consultation and ratification.

B Relationship with the States

The Communicable Diseases Section, within the Commonwealth Department of Health, Housing and Community Services provides input into many national public health committees. The Communicable Diseases Section has custodianship of the national tuberculosis database.

C Pre arrival screening of migrants

The Department of Immigration, Local Government and Ethnic Affairs, in association with the Australian Government Health Services, has the responsibility of applying the policy on the pre arrival screening of migrants and refugees for tuberculosis.

States and Territories

The Role of the States and Territories

A Surveillance at the State and Territory level

The surveillance of tuberculosis at the State and Territory level has different functions to that at the national level. State and Territory wide surveillance mechanisms further identify disease characteristics of subgroups at risk, including patterns of disease at specific settings and in association with other risk factors.

B Management of people with TB

States and Territories have the responsibility of managing outbreaks, controlling the disease in specific sub groups and treating new cases. Active case finding and disease prevention through the use of isoniazid are some of these activities

C Program funding

State and Territory Health Departments have the responsibility of ensuring that the funding for tuberculosis control programs are not diminished, to cause a resurgence of the disease. Program funding and program restructuring should only be planned for in consultation with State/Territory Directors of Tuberculosis.

D Program evaluation

State and Territory Health Departments should evaluate their tuberculosis control programs on a yearly basis to enable better targeting of the goals set out by the program. Program evaluation should be in accordance with the standards set out by the World Health Organization, and should involve specific performance indicators, such as new disease rates, rates of infection, relapse rate and cure rate.

E Specific field studies

Specific field studies should be carried out by State and Territory Health Departments to ensure the monitoring of the rate of infection in each locality.

F Relationship with the Commonwealth

State and Territory Health Departments have a major role to play in national surveillance of tuberculosis by supplying agreed epidemiological data in a timely fashion so as to enable national data collation and analysis.

The roles of the Commonwealth and the State/Territory Health Departments should be clearly delineated so as not to result in duplication of functions. The Commonwealth's role would be in the facilitation of the setting of goals, priorities and standards of practice as agreed by the States/Territories. The role of the State/Territory Health Departments is in the area of operationalising the agreed goals.

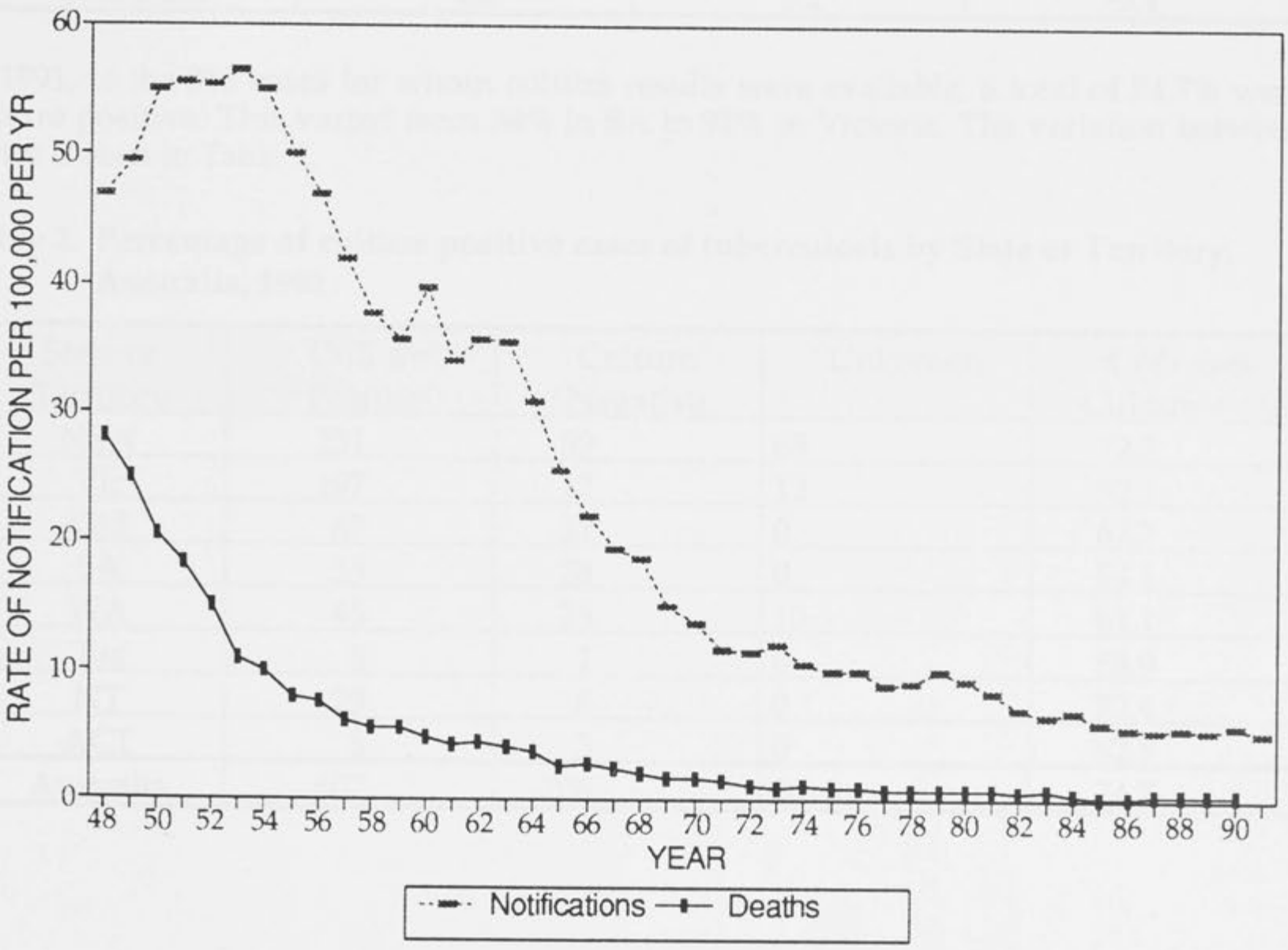
EPIDEMIOLOGY

ACTIVE DISEASE INCIDENCE

In Australia 903 active TB cases were diagnosed and reported in 1991. Of these, 47 (5.2%) were cases of reactivated TB. Of 903 new cases, 289 (76%) had pulmonary disease.

Between 1948 and 1991 the incidence of active disease in Australia declined from 46.8 to 5.2 per 100,000 for new cases and death rates from 28.1/100,000 in 1948 to 0.5/100,000 in 1990 (Figure 1). The incidence of smear positive cases in 1991 was 2.8 per 100,000.

Figure 1. Tuberculosis Notifications and Deaths Australia, 1948-1991



The proportion of **reactivated cases** has remained stable at 5.7% of notified cases in 1979 to 5.2% in 1991.

The notification rates for new cases of TB varied between States and Territories and the number, rate per 100,000 population and percent change from the previous year is seen in Table 1.

Table 1. Notification rates for new cases of tuberculosis, Australia, 1991, by State or Territory

State or Territory	Cases Notified	Rate Per 10^5	% Change in Rate from previous year
NSW	388	6.6	+10.8
Vic	226	5.1	-12.4
Qld	99	3.3	+4.1
SA	61	4.2	-29.1
WA	83	5.0	-31.0
Tas	9	2.0	-19.1
NT	29	18.3	-52.1
ACT	8	2.7	-29.3
Australia	903	5.2	-9.1

In 1991, of the 813 cases for whom culture results were available, a total of 74.7% were culture positive. This varied from 54% in SA to 92% in Victoria. The variation between states is seen in Table 2.

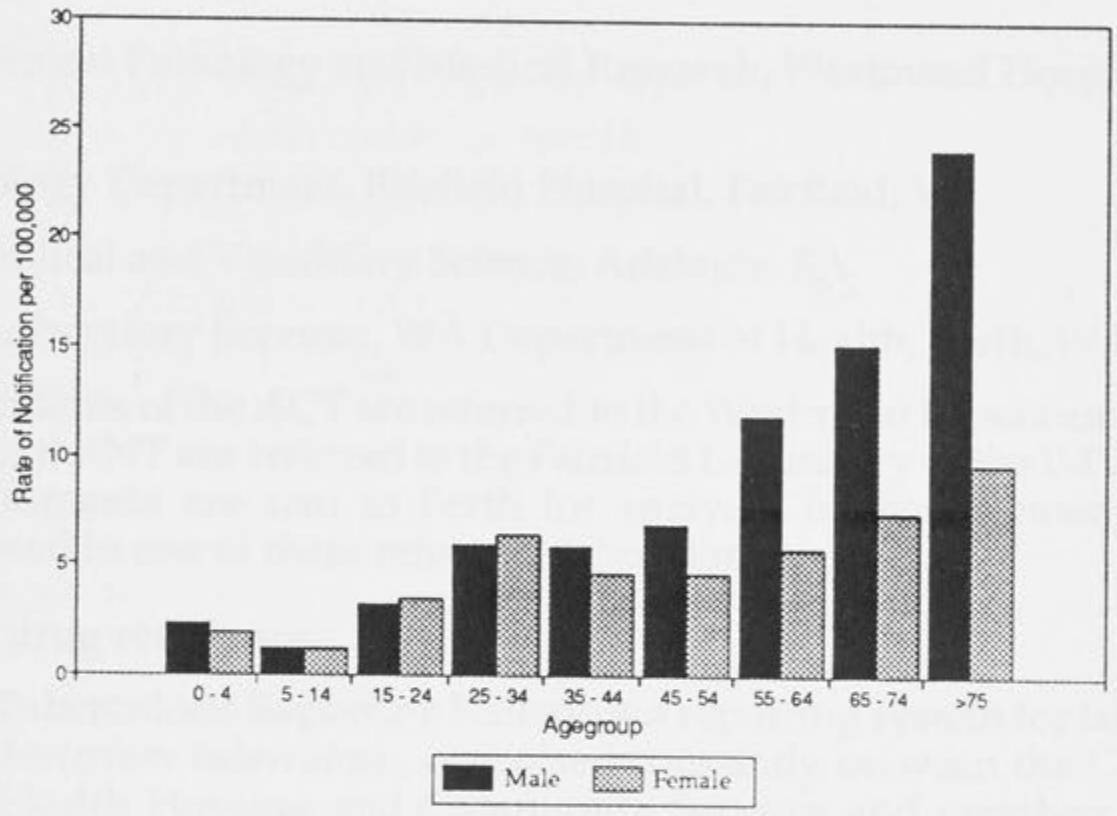
Table 2. Percentage of culture positive cases of tuberculosis by State or Territory, Australia, 1991

State or Territory	Culture Positive	Culture Negative	Unknown	% of cases Culture +ve
NSW	231	89	68	72.2
Vic	197	17	12	92.1
Qld	67	32	0	67.7
SA	33	28	0	54.1
WA	45	28	10	61.1
Tas	8	1	0	88.9
NT	29	8	0	72.4
ACT	5	3	0	62.5
Australia	607	206	90	74.7

AGE AND GENDER OF NOTIFIED CASES

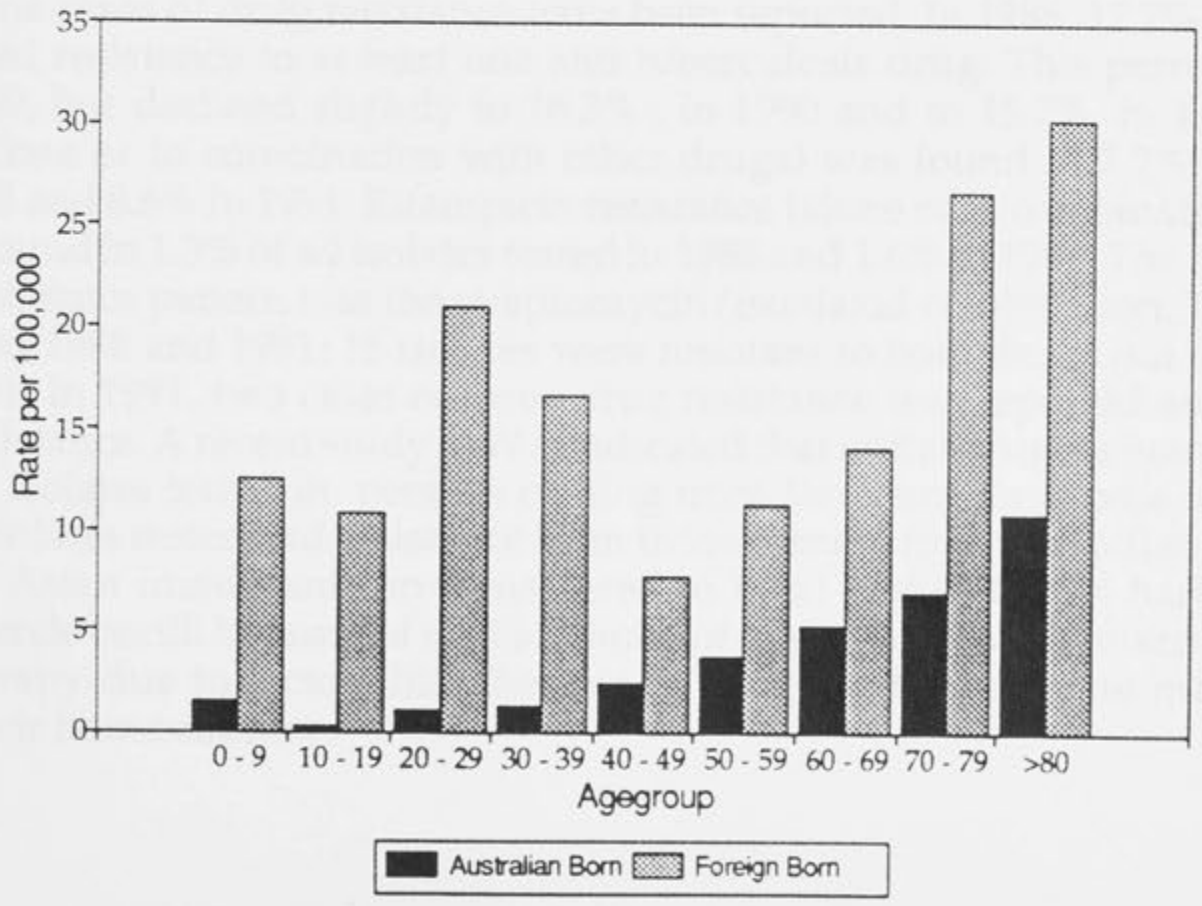
The age group and gender of the cases notified in 1991 are shown in Figure 2.

Figure 2. Tuberculosis in Australia, 1986-91, rate of notification by age and gender



The difference in age of those who are foreign born and those who are Australian born is seen in the following Figure 3.

Figure 3. Tuberculosis in Australia, 1991, comparison of age specific rates



DRUG RESISTANCE IN AUSTRALIA

Sensitivity testing of drug resistance to the commonly used anti tuberculosis drugs is done in the five Tuberculosis Reference Laboratories :

1 Laboratory of Microbiology and Pathology, Queensland Department of Health, Brisbane, Q'ld.

2 Institute of Clinical Pathology and Medical Research, Westmead Hospital, Westmead, NSW.

3 Clinical Pathology Department, Fairfield Hospital, Fairfield, Vic.

4 Institute of Medical and Veterinary Science, Adelaide, SA.

5 State Health Laboratory Services, WA Department of Health, Perth, WA.

Isolates from residents of the ACT are referred to the Westmead Laboratory while isolates from residents of the NT are referred to the Fairfield Laboratory or the IMVS, in Adelaide. Isolates from Tasmania are sent to Perth for analysis. In this manner, all isolates in Australia are tested in one of these reference laboratories.

Surveillance of drug resistance.

The Australian Tuberculosis Reporting Scheme is a reporting system for laboratory based isolates of *Mycobacterium tuberculosis*, organised conjointly between the Commonwealth Department of Health Housing and Community Services and members of the Special Interest Group in Mycobacteria, located in each of the Reference Laboratories. Data are collected for each isolate and sent yearly to the Communicable Diseases Section for collation and analysis. This system, however, does not distinguish between primary or secondary drug resistance and describes only initial drug resistance.

Analysis of data from 1988 to 1991 supports the findings of other studies that drug resistance has not yet emerged as a major threat in tuberculosis control in Australia, although some cases of drug resistance have been reported. In 1988, 12.7% of all isolates tested showed resistance to at least one anti tuberculosis drug. This percentage rose to 17.7% in 1989, but declined slightly to 16.3% , in 1990 and to 15.7%, in 1991. Isoniazid resistance (alone or in combination with other drugs) was found in 7.2% of all isolates tested in 1988 and 8.6% in 1991. Rifampicin resistance (alone or in combination with other drugs) was found in 1.3% of all isolates tested in 1988 and 1.6% in 1991. The most common two-drug resistance pattern was the streptomycin/isoniazid combination. This remained static between 1988 and 1991; 15 isolates were resistant to both drugs out of 650 isolates tested in 1991. In 1991, two cases of three-drug resistance was reported and one case of five-drug resistance. A recent study in WA indicated that initial drug resistance was found in 36% of all isolates tested in persons coming from Vietnam, Cambodia and Laos, and 12.2% of all isolates tested had resistance from those coming from the Indian subcontinent (Pang et al). Asian immigrants are considered to be at higher risk of harbouring drug resistant tubercle bacilli because of the likelihood of inadequate, often interrupted courses of chemotherapy due to factors like the cost of drugs and inadequate management of disease in their home country.

INFECTION PREVALENCE AND INCIDENCE

Data on infection prevalence and incidence rates in sub-populations in Australia are limited.

A recent survey of police recruits in NSW found a Mantoux positivity rate on employment of 11%. In those who had not been previously BCG vaccinated the Mantoux positivity rate was 7%. A Mantoux reaction of 5mm or more was considered a positive result. Using a cut-off point for a positive reaction of 10mm or more, 4% of those who had not previously received BCG vaccination were Mantoux positive.

Preliminary results from a screening survey of Year 8 schoolchildren in Central/ Southern Sydney, an area with a high migrant population, show a Mantoux positivity rate of more than 12%. A Mantoux reaction of 10mm or more was considered a positive result. Other recent screenings in Sydney of Year 4 and kindergarten children have found TB infection prevalence rates of 16% and 13% respectively.

RISK FACTORS

TB morbidity in a population depends upon the risk of infection and the risk of disease following infection. One new TB case on average leads to less than one new infectious case so rates of disease in a stable community should naturally decline.

Some groups have a higher incidence of TB than the general population due to a higher prevalence of infection, or higher risk of developing the disease once infected. Most new cases of TB arise from people with latent rather than new infections. There is often a long latent period between infection and development of TB. It is estimated that more than 90% of people with disease have harboured TB infection for at least a year; the remaining 10% have immediate progression of recently acquired infection.

Age

The risk of TB infection is associated with increasing age in all races and in both sexes. The risk of progression to disease is highest in infants, young adults and the elderly. TB infection acquired in infancy and adolescence carries a high risk of rapid progression to disease; if disease develops, a more serious form (for example meningitis or miliary disease) is more likely to occur. The lifetime risk of TB disease for infected children is up to 10%. The prevalence of disease generally rises steeply with age, particularly for bacteriologically proven disease. Persons over age 50 with unrecognised smear-positive disease are considered major public health risks.

Aboriginality

An active TB incidence rate for Aborigines and Torres Strait Islanders of over 50 per 100,000 has been reported in Australia, however the rate in 1991 was 20/100,000. It is however noted that Aborigines are likely to be underidentified in the data set. Among Aboriginal communities in South Australia the infection prevalence rate in the late 1980s was 16.8% with a range of 7.7%-30.8%.

Country of birth and ethnicity

High rates of infection are found in ethnic groups and immigrants from high prevalence TB countries. Most countries in Asia, Africa and Latin America are high prevalence countries. In Australia only immigrants from the USA, Canada, New Zealand and Scandinavia have incidence rates as low as, or lower, than the Australian-born population. Disease rates in immigrants are highest in the first few years after arrival. Ethnic groups tend to have a higher incidence of active disease especially in the younger age groups (irrespective of country of birth).

Rates per 100,000 by country of birth, 1991 are seen in Table 3.

Table 3. Rate by country of Birth, 1991

Country	No Cases	Rate*	Country	No Cases	Rate*
Australia	307	2.3	Greece	8	5.5
Asia:			Malta	3	5.2
Vietnam	156	116.9	Germany	5	4.1
China	44	64.2	Cyprus	1	3.8
Phillipines	47	63.2	UK/Ireland	36	2.9
India	36	55	Netherlands	2	2
Indonesia	18	53.7	Middle East:		
Hong Kong	15	20.5	Turkey	7	22.7
Sri Lanka	5	12.8	Egypt	3	8.2
Malaysia	6	7.1	Lebanon	4	5.3
Singapore	2	6.8	Others:		
Europe:			USA	3	5.4
Poland	16	21.7	Chile	1	3.8
Yugoslavia	18	10.8	S Africa	3	5.5
USSR/Baltic	5	10.6	Fiji	4	13.5
Hungary	3	10.4	NZ	4	1.4
Italy	21	8			

*Rate per 100,000

In 1991, 66% of all cases were born overseas. Of these, 19% occurred less than 1 year after arrival in Australia, and a further 26% between 1 and less than 5 years after arrival; 55% of overseas born cases were notified 5 or more years after arrival.

For 1990 -1991 the Mantoux positivity rate in Indochinese screened by the NSW refugee screening program was 46% in those who had been previously BCG vaccinated and 40% in those who had not been previously BCG vaccinated. The rates of chest x-ray abnormalities detected by migrant/refugee screening in NSW in 1990 for Vietnamese, Laotians, Kampucheans and Latin Americans were 116.6, 48.0, 95.2 and 105.0 per 100,000 population respectively.

Close contacts

High infection rates are found in close contacts of active pulmonary TB cases. One quarter of contacts of people with TB develop infection with those in close contact being at greatest risk. Up to 2% of contacts of newly discovered TB cases have developed TB disease by their first examination. The risk to contacts of non-pulmonary cases is 1%

Infected contacts are more likely to develop disease if infected by a culture positive case with a positive direct sputum smear than a case with a negative smear. The risk of infection depends largely on the density of *Mycobacterium tuberculosis* in droplets expelled into the air by a person with TB and the time a susceptible person is exposed to that air. The density of infected droplets in the air depends on the frequency of coughing, the density of bacilli in the sputum and the volume of the air space. In NSW in 1991 3.6% of notified active cases were contacts.

Human Immunodeficiency Virus (HIV) infection

The increased incidence of TB overseas, notably in the US in recent years, is partly due to an excess in active disease in those with TB-HIV co-infection.

Although *Mycobacterium avium* complex is the commonest mycobacterial species isolated from people with acquired immunodeficiency syndrome (AIDS), infection of people with AIDS with *Mycobacterium tuberculosis* has the potential for more serious health consequences in the general community. TB-HIV co-infection is characterised by more widespread TB disease with unusual clinical features which may make diagnosis difficult.

In NSW at present the incidence the TB-HIV co-infection is low. In 1991 only ten cases of TB (2.5% of all NSW notifications) were recorded in HIV-positive people.

Other medical risk factors

The risk of progression of infection to disease is high in immunosuppressed people. Silicosis, malignant lymphomas, lung cancer, lymphosarcoma, reticulum cell sarcoma, head and neck cancers, haemophilia, end stage renal failure and patients on haemodialysis are associated with an increased risk of TB. Low body weight, gastrectomy, diabetes, corticosteroid therapy, and HLA types A11, B15 and DR2 have also been implicated. Smokers, particularly those with chronic lung disease, are at increased risk.

Long term residential facilities

In US prisons TB is a major health problem and is increasing. The incidence among New York State prison inmates increased from 15.4 per 100,000 in 1976-8 to 105.5 per 100,000 in 1986, 56% of whom were infected with HIV. Eleven outbreaks in US prisons were reported in the period 1985-88. In the US the incidence of TB in nursing home residents is higher than among elderly people living in the community (39.2 per 100,000 versus 21.5 per 100,000).

In NSW for the period 1989 -1991, there were five notifications of active disease in people identifiable as being resident in nursing homes, three notifications from psychiatric institutions and one notification from gaol.

A survey to estimate the prevalence of infection in new prisoners at Tamworth gaol is currently underway.

Homelessness

High prevalence rates of TB disease (1.6% - 6.8%) and TB infection (18% -51%) have been reported for homeless people overseas. In NSW for the period 1989-91 three cases were notified from 'hostels for the homeless' and one case was recorded as being of 'no fixed address'. In Victoria, one strain of TB has been identified in a number of homeless people.

Drug and alcohol dependency

Drug users and alcohol dependent people are at increased risk of TB. Between 1989 and 1991 in NSW two notified cases were identifiable as being resident in alcohol rehabilitation centres.

Occupation

In the US estimates of the annual incidence of infection in health care workers (HCWs) in recent years have varied between 1.5% and 10.3%. In South Australia the prevalence of TB infection in HCWs under 45 years is 20% - 30%. Research laboratory staff handling infected material are considered at particular risk.

Occupation data are available for 951 of the 1044 notified cases (91%) between 1989 and 1991. Thirty seven cases (4%) were identifiable as HCWs. Of these 37 cases, 28 (76%) were born overseas. Of the nine Australian-born cases, four were medical practitioners (including one retired and two pathologists) and five were nurses (including two retired and one a pathology nurse).

Other 'occupational groups' considered at high risk are the unemployed and pensioners. The incidence of TB is strongly associated with socioeconomic status and income.

Old healed TB

Those with old healed TB (abnormal chest x-rays with fibrotic lesions consistent with old healed TB) are at increased risk of active TB.

POLICIES

SCREENING - TARGET GROUPS

* Due to the low yield, mass population screening is not justifiable except for subgroups with high rates of infection. The rationale is to identify those who would benefit from chemoprophylaxis (or chemotherapy). Screening, by Mantoux testing, is generally recommended where the rate of infection is greater than 1% .

* The predictive value of Mantoux tests is low in populations with a low prevalence of infection. This means that in low risk populations, eg the general population or distant contacts (eg workmates) of cases of low infectiousness, a large proportion of people who may test Mantoux positive are not truly infected.

* As rates of disease decrease, the value of continued screening should be regularly assessed.

* Screening chest x-rays are rarely justified, except when:

a) The objective is to identify those with current pulmonary disease and the administration of chemoprophylaxis to infected people is not possible. Those in hostels for the homeless are suitable for screening by chest x-rays (and possibly sputum smears).

b) There is a high probability of false negative Mantoux reactions, eg in immunosuppressed people. Therefore, a high index of clinical suspicion of pulmonary and extrapulmonary disease should be maintained and appropriate investigations performed for people with clinical AIDS or other HIV-related disease, regardless of the results of Mantoux testing.

* In Australia the following groups should be screened by Mantoux tests (unless otherwise indicated) on a routine or periodic basis:

(i) Routine screening

* Close contacts of people known or suspected to have clinical TB

* People with medical risk factors for TB

* People with HIV infection

* Health care workers/ students at the commencement of employment

* Immigrants (migrants and refugees) from high prevalence countries

(ii) Periodic screening

Residents of hostels for the homeless - six monthly chest x-ray.

Screening

* To identify other high risk groups in Australia, baseline data should be obtained to estimate risk and hence evaluate the need for screening on a routine or periodic basis. The risk should be estimated either by baseline screening surveys or collation and analysis of available data, as indicated:

(1) Routine screening

* Prison inmates on admission - Mantoux screening survey
* Nursing home residents on admission - chest x-ray screening survey
* Injecting drug users - Mantoux screening survey

(ii) Periodic surveys (frequency depending on the estimated rlsk)

Aborigines - Mantoux screening survey

* 'Medium risk' HCWs - Baseline screening surveys and/ or collation and analysis of available data

CONTACT TRACING AND FOLLOW-UP

A. Timing and extent

(1) Each State/Territory should have a well defined method of case notification.

* This should include all doctor notifications of TB and laboratory notifications of mycobacterial infection
* This may be by phone initially, followed up by sending copies of notifications

(2) Cases should be categorised according to the likely degree of infectiousness

'High' * direct sputum smear positive and/ or chest x-ray cavitation

'Medium' * sputum culture positive and direct smear negative, no cavitation on chest x-ray

'Low' * direct smear and culture negative

'Negligible' * extrapulmonary TB (and atypical mycobacterium)

(As culture and identification results are not routinely available for some weeks, initially cases of 'medium' and 'low' infectiousness will not be distinguishable and atypical mycobacteria will not have been identified.)

(3) Contacts should be categorised according to their estimated risk

A list of close contacts, including names and addresses, should be compiled. Contacts should be categorised into:

'High risk' group - frequent, prolonged and close contact within last three months (or as far back as a clear history of active TB disease)

* all people living in the same dwelling
* relatives and friends who have frequent, prolonged and close contact
* any others who have spent significant time with the case in a closed environment

'Medium risk' group - frequent but less intense contact

* other close relatives, friends, schoolmates and work colleagues eg neighbours, relatives who frequently visit the case's home

The 'Low risk' group includes other contacts at school (especially primary schools) or in the workplace or in clubs. However, obtaining details of 'low risk' contacts is not necessary initially and need only be pursued if there is evidence of transmission in the 'high risk' and 'medium risk' groups.

(4)The estimated risk of transmission should guide the priority, rapidity and thoroughness of contact investigation.

* All 'high risk' contacts of all cases of pulmonary disease should be examined.
* 'High risk' contacts of highly infectious cases should be examined within seven days of notification for child contacts and 10 days for adult contacts.
* 'High risk' contacts of cases of 'medium'/ 'low' infectiousness should be examined within 10 days of notification for children and 14 days for adults (or before the case is discharged from hospital).
* Contacts of cases with 'negligible' infectiousness need not be examined. (Contacts of cases of pulmonary atypical disease should have been examined once, however, before identification results are available.)

(5) 'High risk' contacts should be screened first.

Only if there is evidence of transmission in the 'high risk' group, should screening progress to the 'medium risk' group.

Only if there is evidence of transmission in the 'medium risk' group, should screening progress to the 'low risk' group.

'Evidence of transmission' means recent Mantoux conversion and no other identifiable source of infection.

(6) If ten or more of the closest contacts have been tested and all are Mantoux negative, testing of more remote contacts is usually unnecessary.

If less than ten contacts have been tested, and all are negatives, careful consideration should be given to the theoretical risk of infection before stopping the contact investigation.

(7) Before stopping the investigation further consideration should be made:

- if the case works in a hospital, school, day care facility or long term care facility (nursing home, hostel or prison), or
- if in doubt, for any other reason.

B. Procedures

* Contacts who are Mantoux negative throughout the follow-up:

First visit

(i) Mantoux test

ii) chest x-ray - unless aged less than 15 years - chest x-ray to be reviewed by physician

(iii) 48-72 hours later, read Mantoux reaction

Second visit -12 weeks after 1st visit

(i) Mantoux test

(ii) 48-72 hours later, read Mantoux reaction

Third visit -12 months after 1st visit

(i) Mantoux test

(ii) 48-72 hours later, read Mantoux reaction

There should be no further routine follow up.

* **Contacts who are Mantoux positive** at any visit **must** have a chest x ray taken, and be referred to a physician for assessment for chemoprophylaxis (or chemotherapy). The alternative is annual chest x-rays for up to two years.

* **Children aged less than five years who are Mantoux negative** on the first visit should be referred to a physician and be given chemoprophylaxis until the 12 week Mantoux test is shown to be negative, unless contraindicated.

* **Children aged less than 16 years who are Mantoux negative and have continuous exposure to an active case** and a) cannot be placed on isoniazid or b) are exposed to a case with organisms resistant to both isoniazid and rifampicin, should be considered for BCG vaccination prophylaxis.

HEALTH CARE WORKER SCREENING AND PROTECTION

* A high index of suspicion should be maintained to allow early identification and treatment of infectious patients. Effective multidrug therapy should be initiated promptly based on clinical and drug surveillance data.

* Infection control measures should follow established guidelines for AFB isolation precautions; cleaning, disinfecting and sterilising; ensuring adequate ventilation; and special precautions during cough-inducing and aerosol-generating procedures.

* Policy for TB control among hospital staff should be uniform throughout Australia because movement of staff is common. Health care workers (HCWs) should carry a personal record of BCG vaccination and results of employment-related screening from one employment to another.

* All medical, nursing, pathology, radiology and paramedical hospital staff should:

  - receive a Mantoux test on employment unless there is documentation of a positive Mantoux test, adequate treatment for disease or infection, or a negative Mantoux test within the previous three months, and

  - be offered BCG vaccination if Mantoux negative.

* HCWs should not commence work in a high risk area without prior adequate screening.

* Whether and how often screening (Mantoux tests or chest x-rays for Mantoux positive workers) is undertaken during employment should depend on the estimated risk of infection (ie Mantoux conversion rates in cohorts of unvaccinated HCWs).

- HCWs should be classified into 'high', 'medium' and 'low' risk groups. Categorisation of potential risk should depend on a) occupational group, b) risk in community served by health care facility, and c) area worked in health care facility.
- 'High risk' Mantoux negative HCWs should be periodically screened by Mantoux tests during employment. The frequency of screening (eg annually or biannually) should depend on the risk of developing new infection.
- 'Medium risk' Mantoux negative HCWs should also be periodically screened by Mantoux tests during employment, unless the risk of infection is shown to be less than 1% per annum.
- "Low risk" HCWs should not be routinely screened during employment.

* Data on skin test conversions in HCWs should be periodically reviewed so that infection risk can be estimated and the frequency of retesting should be altered accordingly.
* All HCWs should be evaluated according to routine contact-tracing procedures if they are exposed to a potentially infectious TB patient for whom adequate infection-control procedures had not been taken.
* Documentation of the results of employment-related Mantoux tests and chest x-rays must be maintained by the health care institutions.

PROPOSED CATEGORIES OF RISK FOR HEALTH CARE WORKERS

1. 'High' risk category

* All staff working within respiratory clinics and designated chest clinics
* Staff in bronchoscopy theatres
* Medical, nursing staff, radiographers, physiotherapists and students who regularly work with TB or HIV positive patients
* Laboratory staff working with tuberculous material, for example, mycobacteria laboratory, bacteriology, cytology staff
* Mortuary staff

2. 'Medium' risk category

* Other medical and nursing staff, physiotherapists, radiographers, paramedical staff and students involved in direct patient care not included in 'high' risk category
* Ambulance personnel
* Non-clinical staff who are regularly in close contact with patients, for example, wardsmen

3. 'Low' risk category

* Staff who are not routinely exposed to patients or their clinical specimens, for example, kitchen staff, administration and clerical staff

Note: occupational risk is not as much a concern in paediatric hospitals as in adult hospitals because children rarely cough sufficiently or have sufficient cavitatory disease to generate viable organisms. TB incidence in paediatric hospital HCWs probably reflects the incidence in the general population, rather than an occupational risk.

REFUGEE SCREENING AND FOLLOW UP

Refugees who are Mantoux negative throughout follow up:

First visit

(i) Mantoux test

(ii) chest x-ray - unless aged less than 15 years; chest x-ray to be reviewed by physician

(iii) 48 - 72 hours later, read Mantoux reaction

Second visit - 6 months

(i) Mantoux test

(ii) 48 - 72 hours later, read Mantoux reaction

Third visit -18 months

(i) Mantoux test

(ii) 48 - 72 hours later, read Mantoux reaction

There should be no further routine follow-up. Refugees should be advised to seek medical advice if symptoms develop.

* **Refugees who are Mantoux positive** at any screen must have a chest x-ray, and see a physician for assessment for chemoprophylaxis (or chemotherapy). The alternative is chest x-ray follow-up for up to two years.

* **Refugees with chest x-ray abnormalities** should see a physician immediately.

HEALTH UNDERTAKINGS (TBU) FOLLOW-UP

(A) Migrants who have abnormal pre-migration chest x-rays (which may or may not be tuberculous in origin) and/ or have had TB treatment may be permitted entry to Australia if they agree to sign a Health Undertaking (TBU) to adhere to the following conditions:

* report to the state/territory TB Coordinator within four weeks of arrival

* agree to undergo any further tests (eg Mantoux test, chest x-ray, medical examination) as necessary

* agree to undergo supervised medical treatment as necessary

(B) Migrants are referred by the state/territory TB Coordinator to an appropriate clinic.

(C) Clinic appointments should be made:

* immediately - if a) migrants have had TB treatment, or b) their premigration chest x-ray abnormalities are suspicious of active TB disease
* six months after the pre-migration chest x-ray - for others

(D) Routine follow-up - if had previous TB treatment

First Visit

(i) chest x-ray - to be reviewed by physician

(ii) sputum (3) for AFBs - as indicated

(iii) see physician

Second Visit - 6 months

(i) chest x-ray - to be reviewed by physician

(ii) see physician if any changes

Third Visit -18 months

(i) chest x-ray - to be reviewed by physician

(ii) see physician if any changes

Further Visits - annually for up to two more years

(i) chest x-ray - to be reviewed by physician

(ii) see physician if any changes

Routine follow-up - if not had previous treatment

First visit

(i) Mantoux test - if documentation of Mantoux negativity or no documentation of Mantoux status

(ii) chest x-ray - if aged 15 years and over and/ or if Mantoux positive and/ or pre-migration chest x-ray suspicious; chest x-ray to be reviewed by physician

(iii) sputum (3) for AFBs - as indicated

(iv) 48 - 72 later hours, read Mantoux reaction

Migrants with abnormal chest x-rays or positive Mantoux reactions should be seen by a physician.

Migrants with clear post-migration chest x-rays and no other risk factors (e.g. Mantoux positive and recent contact) should be discharged immediately.

Second visit -12 months

(i) chest x-ray - if aged 15 years and over; chest x-ray to be reviewed by physician

(ii) see physician if any changes

Migrants with stable minor chest x-ray abnormalities and no other risk factors should be discharged after 12 months follow-up.

Third visit - 24 months

(i) chest x-ray - if aged 15 years and over; chest x-ray to be reviewed by physician

(ii) see physician if any changes

Migrants with stable chest x-ray abnormalities should be discharged after 24 months follow-up.

On discharge, migrants on TBUs should be advised to seek medical attention immediately if they develop any symptoms.

TUBERCULOSIS IN FOREIGN BORN AUSTRALIANS

The Tuberculosis Panel of the NHMRC has recommended that control of TB can only be achieved by developing different strategies for different high risk groups of individuals. In 1991, 66% of all new notified cases of TB occur in foreign born Australians, with the highest rates occurring in persons born in Vietnam, Philippines, Cambodia, China and Laos. The problem of control in these groups may be multifactorial, including socioeconomic, medical and personal factors. Non adherence to treatment programs overseas and the emergence of multi resistance organisms are threats to achieving control and subsequent elimination to TB in these communities. For these reasons, the following strategies and recommendations are made.

Strategy to improve the effectiveness of screening

It is proposed that in future Mantoux testing be include in the standard requirement for applicants seeking a permanent resident visa. It may be appropriate to target only high risk countries. If the reaction to the Mantoux skin test is more than 15 mm, a TBU will be issued. Australian based chest clinics will then be in position to re test such individuals and if the skin test is confirmed these persons will be prescribed prophylactic isoniazid or 'at risk' cases monitored on a regular basis to ensure early detection of breakdown of tuberculosis.

Recommendations

1 All intending migrants/refugees or individuals wishing to reside in Australia for over 12 months should have a Mantoux Skin Test performed in their home country, in addition to a chest x-ray and medical examination.

2 Those migrants/refugees or individuals who have a positive or substantial Mantoux skin reaction, but who do not have active disease, should be placed on a TBU and be allowed to enter Australia.

3 These people should be re screened upon arrival in Australia to ascertain their TB status again, and be offered preventive chemoprophylaxis where indicated. Chest physicians attending the chest clinics should decide upon the management of individual cases, however preventive therapy should be offered to all Mantoux positive cases unless there are special contraindications.

HIV/AIDS AND TUBERCULOSIS

* The decrease in immunity that occurs in HIV disease, facilitates the development of TB disease. The defect in immunity also diminishes host tissue responses, and in the late stages of HIV disease, results in more easily disseminated disease and sometimes a different clinical picture.

* A high index of clinical suspicion of pulmonary and non pulmonary TB in patients with HIV disease should be maintained and appropriate investigations performed.

* HIV testing should be offered to patients with active TB, if they have a high risk profile for HIV disease, if they have a low risk profile for TB and /or if they have extra pulmonary TB. Risk factors for HIV infection include history of homosexual contact, intravenous drug use, or migration from countries with high prevalence of HIV, for example South East Asia and Africa.

* All HIV seropositive people with a Mantoux reaction 5mm should have chemoprophylaxis, unless medically contraindicated. Recommended duration is 12 months with good supervision and follow-up should continue indefinitely.

* All HIV seropositive people with clinical AIDS or other HIV related disease should have a chest x-ray and be examined for extra pulmonary TB, regardless of the results of Mantoux testing.

* Active TB in HIV seropositive and other immunocompromised people should be treated with conventional medications but for three months longer than for other patients, or a minimum of six months after sputum cultures become negative. Follow-up of HIV/ AIDS patients should continue indefinitely.

* BCG is contraindicated in immunosuppressed patients.

* Infection control measures for TB should be in place when investigating patients with HIV disease.

* Care should be taken with tuberculosis patients in health care settings to avoid contact with immunosuppressed people (including Health Care Workers), in particular HIV/TB co-infected people with other HIV/AIDS people whilst direct smear positive. Investigations which induce coughing, thereby spreading infected droplets, should be avoided.

* Isolation of mycobacteria from HIV seropostive patients should not be assumed to be atypical mycobacteria, for example, *Mycobacterium avium* until confirmation.

TUBERCULOSIS IN CHILDREN AND ADOLESCENTS

Tuberculosis in children and adolescents differs markedly from TB in adults with regard to the following aspects.

A. Risk of disease following primary infection

The lifetime risk of post-primary tuberculosis disease in adults following primary infection is in the range of 5-10%. However, this risk is much greater in children:-

<1 year - 50%

1-5 years - 25%

11-15 years- 15% (females >males)

B. Infectivity

TB in children is "primary" TB, a disease which is predominantly one of delayed hypersensitivity with few organisms and variable immune response. Childhood TB is rarely contagious except in older adolescents with cavitatory disease or laryngeal TB. The reasons are:-

* children with TB disease usually have a small tubercle load.
* children very rarely have cavitating disease.
* children usually swallow their sputum, and have a far less effective cough than adults.

C. Diagnosis

A Mantoux is considered positive if:

>5 mm - when child is at high risk of infection.

>10 mm - when at moderate risk of infection or BCG = 5 years prior.

>15 mm - when at low risk of infection or BCG within 5 years.

Risk Categories

HIGH RISK	MODERATE RISK	LOW RISK
Contacts of infectious cases	Ethnic origin from high prevalence populations	No risk factors
HIV infected or other immunosuppressed (including steroids)	Locally identified high risk populations	
Abnormal chest x-ray	Children 5 years	

D. Chemoprophylaxis

Due to the increased risk of TB disease in children, especially under the age of 5 years, chemoprophylaxis is more commonly recommended than in adults. Chemoprophylaxis, usually with isoniazid alone, is recommended for all children and adolescents who are Mantoux positive but have no clinical or radiological evidence in TB. In the 5 year age group, chemoprophylaxis is indicated if very high risk, irrespective of Mantoux status. Chemoprophylaxis in children, especially under the age of 5 years, should be supervised.

In contrast to adults, the incidence of liver toxicity from isoniazid in children is extremely low. Liver function is evaluated only when clinically indicated, and routine monitoring of liver function is not recommended.

E. Treatment

Adult physicians commonly initiate treatment of active disease using a three times a week regime. Children are usually treated with daily therapy with at least three drugs (usually isoniazid, rifampicin and pyrazinamide) for the first two months. Generally 2 drugs (isoniazid and rifampicin) are then used for a further 4 months and can be given daily or three times a week. Short course chemotherapy (6 months) has been shown to be effective in children, but there are insufficient data to recommend it for CNS, bone or joint TB infections. All treatment regimes in children should be fully supervised.

TUBERCULOSIS IN ABORIGINES

Aborigines have an increase risk of developing tuberculosis because of added risk factors within their community. These include :

1 overcrowding

2 substandard housing

3 poor hygiene

4 poor nutrition

5 high rates of diabetes mellitus, renal disease and chronic lung disease

6 alcoholism

Factors which adversely affect tuberculosis control measures, such as contact screening, preventive treatment and full treatment of cases include :

1 lack of tuberculosis awareness and lack of tuberculosis education

2 cultural barriers

3 staff shortages in rural and Aboriginal medical services

4 population mobility

5 alcoholism

Recognizing that the major advances in Aboriginal tuberculosis control will come from improved socioeconomic factors and empowerment, the following measures are recommended:

1 Community awareness

Aboriginal communities should be made aware of tuberculosis. Videos, flip charts, posters and pamphlets produced from the Aboriginal perspective can help convey this information. Community suggestions for improving nutrition and housing should be sought and addressed. Data collection by the State/Territory tuberculosis control units should be analyzed and reported to community elders, councils, local health care providers and

appropriate social and political groups. Their assistance and participation is essential and should be sought in carrying out all aspects of a control strategy.

2 Integration of State/Territory tuberculosis control unit programs with the local Aboriginal Health Services

A forum of the State/Territory tuberculosis control unit and the local Aboriginal Health Services is necessary to discuss the realities and practicalities of recommended control measures. This forum can then design appropriate tuberculosis prevention and control measures. Resources required need to be identified (e.g. adequate staffing levels) and concerted efforts made to obtain these resources.The State/Territory tuberculosis control unit should have Aboriginal representation.

3 Education of Aboriginal Health Care Providers

* Tuberculosis and its control should be part of the Aboriginal Health Worker training curriculum.
* Tuberculosis and its control should be part of community and rural health nurses and doctors training.
* Alcohol dependence outreach workers, alcohol rehabilitation and detoxification staff should be educated about tuberculosis.
* AIDS education training should include information about tuberculosis.

4 Standard tuberculosis treatment regimens should be formulated from accepted regimens which satisfy the specific needs of Aboriginal communities.

In the past, treatment compliance rates in some communities have been very low and therefore supervised regimens are preferred, and the shortest acceptable regimens are desirable. Fully supervised three times per week intermittent treatment from the start is as effective as daily treatment, especially when four drugs are given. Vitamin B6 (written as the vitamin rather than "pyridoxine", which is confused with "pyrazinamide") must accompany intermittent treatment to avoid the high dose isoniazid side effect of peripheral neuritis. The shortest acceptable regimen, six months of treatment, is made possible when pyrazinamide is used for at least the first two months in addition to six months of isoniazid and rifampicin.

The regimen should be for all tuberculosis cases i.e. newly diagnosed, defaulters and relapsed cases. Therefore a fourth drug, ethambutol is added to cover the possibility of drug resistance. There is already evidence of levels of drug resistance in Australia to cause concern. The NT in 1989 reported 15% isoniazid resistance (6 isolates out of 40 with known sensitivities).

All levels of health care workers dispense drugs and therefore the most straightforward regimen is required.

Where fully supervised treatment is not possible or appropriate, four drug therapy should be given daily for six months.

Hospitalization should only be necessary when medically indicated for advanced or complicated disease, where alcoholism is a co factor, or when young children are put at undue risk from sputum positive cases.

5 Emphasise directly supervised and recorded tuberculosis treatment such that compliance and cure rates can be monitored.

Supervision of treatment should be integrated into the local health service and community at large. Aboriginal Health Workers and community nurses should take responsibility for observing drug taking and recording. Where appropriate, others such as teachers, council members or alcohol outreach workers may supervise and record treatment.

Missed doses should trigger defaulter action of home visits and wider family or community involvement.

Compliance rates should be reported to the tuberculosis control unit on a monthly basis. This reinforces at all levels the importance of compliance, and identifies cases which need special attention.

6 Prompt contact screening for all cases, and "extended contact screening" when two or more cases are identified from one community in one year.

Contact screening should be initiated within 2 weeks of the diagnosis of the index case. Protocols for contact tracing will vary depending on the degree of contact and infectiousness of the case.

The "extended contact screening" may include screening an entire community. This requires community tuberculosis awareness and education and the full support of the community and council. Those 10 years of age and older should have a Mantoux test and then a chest x ray if Mantoux positive.

Portable x ray equipment is now both affordable and manageable and may provide the most economical and acceptable method of screening remote communities.

7 Routine screening of specific groups.

Certain groups are at an even higher risk of tuberculosis within the Aboriginal community and they should be routinely screened (e.g. annually). These groups include :

- health care providers
- nursing home and frail aged hostel residents and staff
- alcohol rehabilitation and detoxification clients and staff
- all HIV positive persons
- prisoners

8 BCG immunisation is recommended for all Aboriginal neonates in high incidence regions.

BCG is no longer routinely given in Australia but is recommended for those with potential close contact to active tuberculosis cases. Its main value appears to be in infancy and childhood when there is the highest risk of death from rapidly progressive disease.

Prior BCG immunisation provides some immunity but should NOT be presumed to be preventive. Where clinical features suggest tuberculosis, the diagnosis must be pursued whether or not BCG has been given previously.

BCG immunisation should not be given to neonates of mothers with known AIDS or HIV infection or to neonates of HIV untested mothers with known high risk behaviour or known risk factors for HIV.

9 Promotion of appropriate use of preventive treatment.

The main purpose of preventive treatment is to stop dormant (asymptomatic) infection from progressing to clinical disease.

Often appropriate persons for preventive treatment are highly mobile and have complicating factors such as alcoholism which may compromise compliance and increase drug side effects.

Care must be taken to identify those most at risk of progression to disease, who will benefit most from preventive treatment and not overstretch the community health services.

Preventive treatment is isoniazid for six months, either daily, or as a supervised higher dose (with vitamin B6) three times weekly. For HIV positive people it is extended to 12 months.

Priority persons for preventive treatment are :

(1) Mantoux positive contacts under five years of age. Young children are at such high risk of progression to disease that supervised treatment should be resourced if thought necessary.

(2) Other close contacts who are Mantoux positive, or those who are known to be newly converted at any age. Those motivated and accepting of self treatment should be given daily treatment. Supervised prevention treatment should be considered for those less motivated if resources allow.

Where indicated Mantoux positive Aboriginal prisoners should be considered for preventive treatment while imprisoned.

All persons on preventive treatment must be reviewed monthly.

10 Promote Mantoux screening of 10 year olds

This will provide data on the prevention of infection in one cohort of the community.

Annual Mantoux screening of 10 year olds affords a provision for ongoing assessment of the average annual TB infection rates.

Done regularly it will reflect the effectiveness of a community tuberculosis control program.

The annual risk of infection (which is not a simple relationship with the annual tuberculosis infection rate because of increasing risk with age) can be calculated and is considered the best single index of the extent of the tuberculosis problem in a community and provides a measure of ongoing transmission.

Obviously case finding is not the intent of the 10 year old screening, but if disease is found it allows curative treatment and contact tracing. Active cases have been discovered in 10 year old screening in years 1989, 1990 and 1991 in the NT.

In addition, Mantoux positive 10 year olds may be appropriate for preventive treatment, and their families should be screened to identify further infection or disease.

If it is not possible to screen 10 year olds in all Aboriginal communities then sentinel communities should be chosen.

BCG VACCINATION

BCG (Bacille-Calmette-Guerin) vaccine contains a live attenuated strain of *Mycobacterium bovis* - the mycobacterium has lost its virulence but retains its antigenic property. BCG can produce immunity, overseas trials showing protection varying from 0-75%, but rarely produces disease. In contrast, natural infection with virulent *M. tuberculosis* produces immunity, and causes disease in 5-10% of people.

A. Indications

* children aged less than 16 years who:
  - have continuous exposure to people with active disease when:
  - the child cannot be placed on isoniazid therapy
  - the active case has organisms resistant to both isoniazid and rifampicin - belong to groups with new infection rates of more than 1% per year

* children and adults who:
  - are travelling overseas to live in a high prevalence country for a prolonged period (12 months or more)

* health care workers who:
  - belong to occupational groups and work in settings where the new infection rate is greater than 1% per year

B. Contraindications

* Relative:
  - age 35 years
  - pregnancy

* Absolute:
  - primary or secondary immunosuppression, including people with HIV infection or high risk for HIV infection where status is unknown or receiving corticosteroids, immunosuppressive drugs or irradiation
  - malignancies involving bone marrow or lymphoid systems
  - septic skin conditions
  - Mantoux positivity

CHEMOPROPHYLAXIS

* Unless specifically contraindicated, chemoprophylaxis should be considered for all high risk Mantoux positive people, such as:
* contacts of people with TB
* recent Mantoux converters (within two years)
* people with medical risk factors for TB
* HIV infected people
* intravenous drug users people with chest x-rays suggestive of inactive TB in whom active disease is excluded and who have not completed treatment for TB .
* others under 45 years of age (including migrants/refugees and residents of long term facilities with no other risk factors).
* Chemoprophylaxis should be offered to all Mantoux negative children under five years of age who are close contacts of high risk (direct smear positive) people with TB. Prophylaxis should continue until a repeat test in 12 weeks (after contact is broken) is also shown also to be negative.
* Chemoprophylaxis should be for a minimum of six months. Six month regimens are preferable to maximise compliance and minimise costs. Exceptions are those with HIV or an abnormal chest x-ray consistent with old inactive TB who should be treated for at least 12 months.
* Direct supervision with three times weekly short regimens is indicated for children aged less than five years of age and others at high risk of developing TB.
* Multidrug regimens should be considered for people at high risk of severe forms of disease who are likely to be infected with isoniazid resistant organisms.
* Isoniazid chemoprophylaxis is contraindicated for people with a history of hepatitis or alcoholism. Where there is doubt, long term surveillance is recommended.
* People receiving chemoprophylaxis must be reviewed at least monthly for side effects and to assess compliance.
* Chemoprophylactic drugs have side effects and are potentially toxic. The benefits of treatment must be weighed against the risks and costs, and the decision for treatment must be individually assessed.

CHEMOTHERAPY

Chemotherapeutic regimens for tuberculosis should be chosen in accordance with the National Health and Medical Research Council (NHMRC) guidelines.

* A high index of suspicion should be maintained to identify cases rapidly. This is particularly the case for patient populations who commonly present atypically, for example, the elderly and HIV patients.

* Effective multi-drug anti-TB therapy should be initiated promptly based on clinical (high index of suspicion or confirmation) and drug resistance surveillance data.

* If drug resistance is suspected, cases should be treated as drug resistant until proven otherwise. Drug resistance should be suspected with a history of previous chemotherapy, especially if inadequately supervised or documented, or place of birth in Asia, Africa or Latin America.

* People with direct sputum smear positive TB should be treated with appropriate anti-TB drugs in a single room for at least two weeks. Acid fast bacilli (AFB) precautions should be continued until the AFBs are clearing from sputum specimens and there is a significant clinical improvement.

* Drug regimens of at least six months duration are recommended for both smear negative and smear positive patients. In any case therapy must be long enough to fulfil the requirements of the given regimen. Pyrazinamide must be included in the first two months of any six month regimen.

* Chemotherapy should be fully supervised, with a three times weekly regimen, for all pulmonary and non-
pulmonary cases. Full supervision requires the actual observation of drug ingestion and a written record of drug administration (patient and clinic held).

* The progress of smear positive patients on chemotherapy must be monitored by sputum examination at regular intervals until the sputum is smear negative.

* Patients successfully treated for TB should not be routinely followed for longer than three years after treatment is completed. They should be given a copy of their latest chest x-ray and advised about TB symptoms and urged to seek medical care immediately if symptoms appear.

* Active TB in HIV-seropositive and other immunocompromised people should be treated with conventional medications but for three months longer than for other patients, or a minimum of six months after sputum cultures become negative. Follow-up of HIV/ AIDS patients should continue indefinitely.

APPENDIX A - CASE DEFINITIONS

TUBERCULOSIS

Tuberculosis is notifiable under the public health acts in all States and Territories.

Tuberculosis case definitions are as follows:

* Clinical Criteria

Signs and symptoms compatible with pulmonary tuberculosis, with an abnormal, unstable chest x-ray, **or**

Signs and symptoms compatible with extra-pulmonary tuberculosis, **or**

Evidence of disease where treatment, with two or more antituberculous medications, has been prescribed.

*** Laboratory Criteria**

Isolation of *Mycobacterium tuberculosis, Mycobacterium bovis or Mycobacterium africanum* from a clinical specimen, **or**

Demonstration of acid-fast bacilli in clinical specimen when a culture has not been or cannot be obtained, in a person suspected of having signs and symptoms compatible with tuberculosis.

NEW/ CHRONIC/ REACTIVATED CASES

Relapse - TB case proven clinically, radiologically or bacteriologically following at least 12 months quiescence after full chemotherapy has stopped (as deemed appropriate by the Director of TB) and cure was bacteriologically proven

New case - has never received anti-TB treatment for more than one month.

Treatment failure - still direct smear positive at five months or more after the start of chemotherapy for a newly diagnosed case of TB

Returning defaulter - interrupted treatment for more than 2 months after completing the first month of chemotherapy, returned to treatment and was found to be direct smear positive

Chronic case - still discharging AFB after completing a re-treatment regimen under supervision

CAUSE OF DEATH

Deaths caused by TB - principal cause of death was TB

Deaths incidental to TB - principal cause of death is not TB but TB may be a contributing factor

APPENDIX B - PAPERS SUBMITTED

1. STRATEGIES FOR TB CONTROL IN THE LOWER RISK GROUPS

Introduction

Australia has a long-term vision of a society which is Tuberculosis free. For this to be achieved transmission of infection must stop, or new means of treatment developed which will simply and totally kill TB germs in individuals from past or current infection. At the moment this is only partially achievable, and so the lesser goal of elimination of Tuberculosis is Australian born persons, and satisfactory control in other groups by the year 2020 is the current target. That the latter is achievable is shown by the fact that the standards set for this are being met in the large group of young and adolescent Australian born persons.

Risk Groups

These can be defined according to the prevalence of existing infection or disease or the incidence according to the annual risk of infection.

The size of the non infected population depends on avoidance of transmission of infection to the Australian born population, and thus on the effective active case finding procedures being adopted in high risk groups. It also depends on the numbers of migrants and refugees entering Australia. Currently the yearly numbers are similar to the Australian birth rate.

It may be that the population should be divided into 3 groups, those in whom "elimination" has been achieved, those in whom the infective rate is higher than 1 per 1,000,000 but the active disease rate is less than 1 per 100,000 and the higher risk group.

Criteria for "Elimination"

1 An annual infection rate of less than 0.5 per thousand.

2 Prevalence of infection of less than 1 per million.

3 Prevalence of active disease of less than 1 per hundred thousand.

Strategies to achieve this

1 The identification of those groups currently meeting criteria as above.

2 Periodic monitoring of these groups.

3 The development of agreed criteria, and their improvement over a period of time.

4 The protection of these groups from transmission of infection by effective active case finding and treatment of persons of higher risk of developing active transmittable disease.

5 Discussion whether an intermediate risk group exists, which may not require active case finding strategies, but more frequent monitoring. (This could be considered the low risk group).

6 The development of methods to effectively making the community, government and health workers aware of these groupings, the rationale for the strategies to be used, and their own status.

Barriers to achieving these goals

1 Lack of community, government and health worker knowledge.

2 A non standardised national approach.

3 Focus on data collection about active disease and death, with little data collection about infection rates.

4 Cross reactivity between various forms of microbacterial disease on tuberculin skin testing.

5 Inability to mount effective epidemiological studies of annual infection rate in low risk or non infected persons because of the reduced sensitivity and specificity of tuberculin skin testing in these groups and the non availability of better measurement tools.

2. STRATEGIES FOR TB CONTROL IN ABORIGINAL PEOPLE

Introduction

Tuberculosis is recognised as occurring within fairly well defined "at risk" groups in Australia today, and Aboriginal people are one of these groups.

Following the entry into Australia of non Aboriginal people the ravages of tuberculosis on the newly exposed Aboriginal population was similar to those seen in indigenous people elsewhere. The early impact and spread of tuberculosis in Aboriginals is well summarised in a recent publication edited by Proust (1). It is noted that the major impact of the disease came with the subjugation of Aboriginal people and the subsequent poverty, overcrowding and poor nutrition. These socioeconomic disadvantages remain today and contributed to the continuing problem of tuberculosis in sections of the Aboriginal population.

Background

The well organised National TB Control Plan introduced in 1948 saw the incidence of tuberculosis in Australia decrease from 50 per 100,000 to 10 per 100,000 in 1976, when federal funding of the program ended. To characterise the reduction in tuberculosis in the Aboriginal population over that time period is problematic as the collection of Aboriginal health data has been fraught with difficulties and inaccuracies. In fact, Aboriginal health statistics were not routinely collected until the mid 1960's and indeed Aboriginal people were only first counted in the citizen census in 1971. The Northern Territory (NT) Aboriginal tuberculosis rate over the period 1969-1974 was 135 per 100,000 and over 1981-1983, when the NT Tuberculosis Control Unit was disbanded, it was 54 per 100,000, which was the rate which initiated a multimillion dollar national program thirty years earlier. In 1989 there were 7 deaths attributed to tuberculosis making the NT Aboriginal tuberculosis mortality rate 19 per 100,000. For 1989 and 1990 the NT Aboriginal notified tuberculosis cases represented 67% (42 cases) and 70% (44 cases) respectively of the total notifications. The NT Aboriginal tuberculosis incidence rate in 1989 was 114 per 100,000, twenty times the national rate and in the Katherine region the Aboriginal rate was 365 per 100,000 (2). The peak age range in the Aboriginal cases was in the 30 to 40 year olds with a higher female to male ratio of 1.2 to 1. Following the noted rise in cases in the late 1980s the N.T. re established its Tuberculosis Control Unit in 1989 and put forth a five year plan with priorities for case reduction and prevention. In 1990 and 1991 the treatment compliance rates were 86% and 96% respectively. In 1991 the Aboriginal cases decreased to 23 cases (still 74% of the total N.T. cases), with a rate of 60 per 100,000 (3).

Penny and Thompson in analysing national Aboriginal tuberculosis data for 1984 showed age adjusted Aboriginal rates were 18.7 times the non Aboriginal rate, with the male rate being 16.4 times higher and the female 22.8 times higher (4). Queensland has had a decline in Aboriginal tuberculosis cases but the rates remain comparatively higher than non Aboriginals. The Aboriginal cases in Queensland in 1990 accounted for 9% of notified cases (8 cases), with a rate of 11.1 per 100,000 as compared with the non Aboriginal Australian born rate of 1.5 per 100,000. The disease in Aboriginals is evenly distributed across the age groups(5).

South Australia reports high rates of active tuberculosis in its Aboriginal population with incidence rates 4 times the total South Australian rate. The incidence is higher in traditional and rural communities than in urban Aboriginal people. The age and sex distribution still

reflects the Western model of a predominance of disease in middle aged men, though at an even higher rate than the South Australian non Aboriginals(6).

Infection rates are a sensitive indicator as to the extent of the tuberculosis problem in communities. The prevalence of tuberculosis infection based on tuberculin skin test surveys in South Australia in 1987 showed a 2.8% infection prevalence in 0 - 14 year olds compared with 1.2% in non Aboriginal children. Those Aboriginals 35 years and over showed a 52.6% infection prevalence - a proportion no better than 30 years ago(7). The NT school survey of 10 and 14 year olds in 1991 showed a 2.8% infection prevalence in Aboriginals compared with 2.1% in the Australian born non Aboriginals and 7.8% in those born overseas (personal communication, V Krause).

Risk factors for acquiring tuberculosis infection and progression to disease in the Aboriginal communities today include :

- overcrowding
- substandard housing
- poor hygiene
- poor nutrition
- high rates of diabetes mellitus (which confers a 10 fold risk of infection progressing to disease), renal disease and chronic lung disease.
- alcoholism.

Tuberculosis is a prominent opportunistic infection in the setting of poverty and newly exposed populations, and it is an especially important opportunistic infection in the presence of HIV infection. With an inadequate cell mediated immune response dormant (endogenous) infection will progress to clinical disease. Although most cases with tuberculosis and AIDS are from dormant (endogenous) infection, progressive immuno suppression also increases susceptibility to new (exogenous) infection. Therefore HIV infection in the Aboriginal community poses a major threat to tuberculosis control.

Factors in Aboriginal communities which adversely affect tuberculosis control measures such as contact screening, preventive treatment (elimination of infection) and full treatment of diseased cases include :

- lack of tuberculosis awareness and lack of tuberculosis education.
- cultural barriers.
- staff shortages in rural and Aboriginal medical services.
- population mobility.
- alcoholism.

Recommendations

Recognising that the major advances in Aboriginal tuberculosis control will come from improved socioeconomic factors and empowerment, the following measures are recommended :

1 Community awareness

TB is a community disease and needs community action to fight it .

Aboriginal communities should be made aware of tuberculosis - what it is, how it is diagnosed, how it is spread to family and community members, how it can be prevented and cured and what services are available.

Videos, flip charts, posters and pamphlets produced from the Aboriginal perspective can help convey this information.

Community suggestions for improving nutrition and housing should be sought and addressed.

Data collection by the State/Territory tuberculosis control units should be analysed and reported to community elders, councils, local health care providers and appropriate social and political groups. Their assistance and participation is essential and should be sought in carrying out all aspects of a control strategy.

2 Integration of State/Territory tuberculosis control unit programs with the local Aboriginal Health Services.

A forum of the State/Territory tuberculosis control unit and the local Aboriginal Health Services is necessary to discuss the realities and practicalities of recommended control measures. This forum can then design appropriate tuberculosis prevention and control measures. Resources required need to be identified (eg adequate staffing levels) and concerted efforts made to obtain these resources.

The State/Territory tuberculosis control unit should have Aboriginal representation.

The State/Territory tuberculosis control unit should be used as a resource unit by the local health service to :

(1) provide ongoing tuberculosis education and inservices (eg procedural training on Mantoux testing, BCG administration and contact tracing protocol)

(2) provide resource materials (eg videos, pamphlets, treatment cards, etc) and

(3) provide clinical expertise in tuberculosis diagnosis and disease management.

3 Education of Aboriginal Health Care Providers

Tuberculosis and its control should be part of the Aboriginal Health Workers training curriculum.

Tuberculosis and its control should be part of community and rural health nurses and doctors training.

Alcohol dependence outreach workers, alcohol rehabilitation and detoxification staff should be educated about tuberculosis.

AIDS education training should include information about tuberculosis.

Workshops should be run by the State/Territory tuberculosis control unit to update health staff on anti tuberculosis drugs, their side effects, clinical presentation of disease, methods to improve treatment compliance etc.

4 Standard tuberculosis treatment regimens should be formulated from accepted regimens which satisfy the specific needs of Aboriginal communities.

In the past, treatment compliance rates in some communities have been very low and therefore supervised regimens are preferred, and the shortest acceptable regimens are desirable. Fully supervised three times per week intermittent treatment from the start is as effective as daily treatment, especially when four drugs are given (9). Vitamin B6 (written as the vitamin rather than "pyridoxine", which is confused with "pyrazinamide") must accompany intermittent treatment to avoid the high dose isoniazid side effect of peripheral neuritis. The shortest acceptable regimen, six months of treatment, is made possible when pyrazinamide is used for at least the first two months in addition to six months of isoniazid and rifampicin.

The regimen should be for all tuberculosis cases ie newly diagnosed, defaulters and relapsed cases. Therefore a fourth drug, ethambutol is added to cover the possibility of drug resistance. There is already evidence of levels of drug resistance in Australia to cause concern. The NT in 1989 reported 15% isoniazid resistance (6 isolates out of 40 with known sensitivities). The Special Interest Group in Mycobacteria reported in the same year from the five State tuberculosis reference laboratories 17.7% (108 isolates out of 610) with resistance to at least one standard anti tuberculosis drug (10).

All levels of health care workers dispense drugs and therefore the most straightforward regimen is required.

The recommended standard tuberculosis treatment therefore is a fully supervised, intermittent (2 or 3 times per week) 4 drug (plus vitamin B6) regimen for 6 months.

- Isoniazid
- Rifampicin — supervised
- Pyrazinamide — 3 x weekly
- Ethambutol — for 6 months

plus

Vitamin B6

Where fully supervised treatment is not possible or appropriate, four drug therapy should be given daily for six months.

Hospitalisation should only be necessary when medically indicated for advanced or complicated disease, where alcoholism is a co factor, or when young children are put at undue risk from sputum positive cases.

5 Emphasise directly supervised and recorded tuberculosis treatment such that compliance and cure rates can be monitored.

Supervision of treatment should be integrated into the local health service and community at large. Aboriginal Health Workers and community nurses should take responsibility for

observing drug taking and recording. Where appropriate, others such as teachers, council members or alcohol outreach workers may supervise and record treatment.

Where fully supervised treatment is not feasible or appropriate a dosette of daily drugs should be given on a weekly basis and thereby compliance checked and recorded weekly.

Missed doses should trigger defaulter action of home visits and wider family or community involvement.

Compliance rates should be reported to the tuberculosis control unit on a monthly basis. This reinforces at all levels the importance of compliance, and identifies cases which need special attention.

6 Prompt contact screening for all cases, and "extended contact screening" when two or more cases are identified from one community in one year.

Contact screening should be initiated within 2 weeks of the diagnosis of the index case. Protocols for contact tracing will vary depending on the degree of contact and infectiousness of the case.

The "extended contact screening" may include screening an entire community. This requires community tuberculosis awareness and education and the full support of the community and council. Those 10 years of age and older should have a Mantoux test and then a chest x ray if Mantoux positive.

Portable x ray equipment is now both affordable and manageable and may provide the most economical and acceptable method of screening remote communities.

7 Routine screening of specific groups.

Certain groups are at an even higher risk of tuberculosis within the Aboriginal community and they should be routinely screened (eg annually). These groups include :

- health care providers
- nursing home and frail aged hostel residents and staff
- alcohol rehabilitation and detoxification clients and staff
- all HIV positive persons
- prisoners

8 BCG immunisation is recommended for all Aboriginal neonates in high incidence regions.

BCG is no longer routinely given in Australia but is recommended for those with potential close contact to active tuberculosis cases. Its main value appears to be in infancy and childhood when there is the highest risk of death from rapidly progressive disease.

Prior BCG immunisation provides some immunity but should NOT be presumed to be preventive. Where clinical features suggest tuberculosis, the diagnosis must be pursued whether or not BCG has been given previously.

BCG immunisation should not be given to neonates of mothers with known AIDS or HIV infection or to neonates of HIV untested mothers with known high risk behaviour or known risk factors for HIV.

9 Promotion of appropriate use of preventive treatment.

The main purpose of preventive treatment is to stop dormant (asymptomatic) infection from progressing to clinical disease.

Often appropriate persons for preventive treatment are highly mobile and have complicating factors such as alcoholism which may compromise compliance and increase drug side effects.

Care must be taken to identify those most at risk of progression to disease, who will benefit most from preventive treatment and not overstretch the community health services.

Preventive treatment is isoniazid for six months, either daily, or as a supervised higher dose (with vitamin B6) three times weekly. For HIV positive people it is extended to 12 months.

Priority persons for preventive treatment are :

(1) Mantoux positive contacts under five years of age. Young children are at such high risk of progression to disease that supervised treatment should be resourced if thought necessary.

(2) Other close contacts who are Mantoux positive, or those who are known to be newly converted at any age. Those motivated and accepting of self treatment should be given daily treatment. Supervised prevention treatment should be considered for those less motivated if resources allow.

Where indicated Mantoux positive Aboriginal prisoners should be considered for preventive treatment while imprisoned.

All persons on preventive treatment must be reviewed monthly.

10 Promote Mantoux screening of 10 year olds

This will provide data on the prevention of infection in one cohort of the community.

Annual Mantoux screening of 10 year olds affords a provision for ongoing assessment of the average annual TB infection rates.

Average Annual TB infection rate =

$$\frac{\text{\% of Mantoux +ve 10 yr olds}}{10}$$

assuming an equal chance of infection in each year of life (8).

Done regularly it will reflect the effectiveness of a community tuberculosis control program.

The annual risk of infection, which is not a simple relationship with the annual tuberculosis infection rate because of increasing risk with age can be calculated and is considered the best single index of the extent of he tuberculosis problem in a community and provides a measure of ongoing transmission.

Obviously case finding is not the intent of the 10 year old screening, but if disease is found it allows curative treatment and contact tracing. Active cases have been discovered in 10 year old screening in years 1989, 1990 and 1991 in the NT.

In addition, Mantoux positive 10 year olds may be appropriate for preventive treatment, and their families should be screened to identify further infection or disease.

If it is not possible to screen 10 year olds in all Aboriginal communities then sentinel communities should be chosen.

References

1. Proust, AJ (Ed). History of Tuberculosis in Australia, New Zealand and Papua New Guinea. Brolga Press. Canberra 1991.

2. Krause V. Priorities for tuberculosis control in the Northern Territory. Abst. Aust. N.Z. J. Med 1991;21 (Supp 2) : 595.

3. Krause V. Tuberculosis in the Northern Territory of Australia : Human Resources Must Complement Technology. Abst. XIII Internal Congress for Tropical Medicine and Malaria Thailand 1992. (in press).

4. Penny, Mand Thomson N. A Preliminary analysis of Aboriginal Tuberculosis. Aboriginal Health Information Bull 1987;8:15-18.

5. Queensland Health and Medical Services Annual Report (Tables) Tuberculosis in Queensland 1990 : SHS, Mar 92 : 7.

6. Beilby J et al. Tuberculosis surveillance in the South Australian Aboriginal Community. Med J Aust 1990;153:149-152.

7. NH&MRC Tuberculosis in Australia and New Zealand into the 1990's. AGPS Canberra 1990 :9.

8. Shears P. Tuberculosis Control Programmes in Developing Countries. Oxfam, Oxford 1985.

9. Hong Kong Chest Service/British Medical Research Council, Controlled trial of 2,4 and 6 months of pyrazinamide in 6 months, three times weekly regimens for smear positive pulmonary tuberculosis, including and assessment of a combined preparation of isoniazid, rifampicin and pyrazinamide. Am Rev Respir Dis 1991;143:700-706.

10 Dawson D. Tuberculosis in Australia:an unfinished fight. Med J Aust 1991;154:75-76.

11 NH&MRC Tuberculosis in Australia and New Zealand into the 1990's. AGPS. Canberra 1990:68-70.

3. PROBLEMS IN TUBERCULOSIS CONTROL - HOMELESSNESS

The homeless are a heterogeneous group of men, women and children, including long-term street dwellers, residents of shelters, the chronically mentally ill, the economically debased, and alienated youth. They are subject to a broad range of acute and chronic diseases, intensified by unsuitable living conditions, stress, and occasionally sociopathic behaviour.

There are a number of factors which increase the risk of tuberculosis (TB) in the homeless:

- Incomplete and fragmentary medical care permits exacerbation of TB. TB patients who are homeless infrequently complete a course of chemotherapy, risking treatment failure, recurrence, and continued spread of infection in the community. Obstacles to successful treatment include an erratic schedule, mistrust of authority and the medical system, and uncooperative or aggressive behaviour.
- Cohabitation in overcrowded dormitories creates a risk of airborne transmission of tuberculosis.
- Chronic substance abuse may complicate compliance and add further difficulties to the monitoring of chemotherapy. At the same time, monitoring becomes even more important in the effort to minimise adverse effects of the medications.
- OuTBreaks of drug-resistant disease have recently occurred, complicating the selection of drugs and affecting the duration of treatment.

Successful management of these problems requires the use of proven case finding techniques, a correct choice of drug regimen, and a prompt and appropriate response to the patient who is lost or refuses treatment. Nine and six month drug regimens with proven success are now available; however, the direct observation of medication taking should be maximised. Patient default may be further minimised by encouraging prompt notification of the Health Departments. Occasionally, the threat or use of existing public health laws on confinement for purposes of treatment are required for noncompliant patients.

Factors that may be used to assess the risk of TB in an institution are :

- the entrance point prevalence of infection among institutional residents and staff.
- the potential for reactivation.
- the role of transmission within the institution.
- the potential for detection of infection and disease.
- the potential for prevention and treatment of disease, and
- the potential of the building environment to favour transmission.

The goals of a TB control plan :

- to recruit homeless individuals into screening and treatment programs; to find undiagnosed infectious cases by undertaking repetitive mass screenings (chest x-ray and tuberculin testing).
- to maximise compliance to screening and treatment programs
- to render known infectious cases non-infectious through supervised therapy

- to protect exposed clients by repetitive tuberculin skin testing and isoniazid preventive therapy, and
- to make the shelter environment safe by excluding infectious, noncompliant clients, and improve the shelter's ventilation system.

PRIMARY STRATEGIES

- TB should be suspected and sputum samples should be collected from any homeless individuals with a productive cough
- Diagnosed or suspected tuberculosis in a homeless individual should be immediately reported to the Health Department
- Therapy should be fully supervised by a responsible person, and an intensive multidrug, six month regimen should be utilised whenever possible
- Contact tracing should be conducted around each infectious case, and supervised preventive therapy should be prescribed for high risk infected individuals
- Shelter staff should receive a tuberculin skin test when they start work and every twelve months thereafter
- Skin test reactors should be considered for preventive therapy according to current guidelines
- Expanded HIV antibody testing and counselling should be offered to residents of shelters, and
- On site medical services should be offered to residents of shelters
- Medically appropriate housing should be provided to homeless persons.

SECONDARY STRATEGIES

- Faster culture methods should be used to allow identification of the bacterium, and determine drug sensitivities within two weeks
- Research on serological and recombinant nucleic acid methods of detecting tuberculosis in various body fluids and secretions
- Primary care physicians should be informed about the recognition of early forms of TB.

References

1. Slutkin G. Management of tuberculosis in urban homeless indigents. Public Health Rep 1986;101:481-485.
2. Nardell EA. Tuberculosis in homeless, residential care facilities, prisons, nursing homes, and other close communities. Semin Respir Infect 1989;4:206-215.
3. Nolan CM, Elarth AM, Barr H, Saeed AM, Risser DR. An ouTBreak of tuberculosis in a shelter for homeless men. A description of its evolution and control. AM Rev Respir Dis 1991;143:257-261.

4. Schieffelbein CW Jr; Snider DE Jr.Tuberculosis control among homeless populations. Arch Intern Med 1988;148:1843-1846.

5. Leads from the MMWR. Tuberculosis control among homeless populations. JAMA 1987;257:2886-2888.

6. Torrens RA, Mani S, Altholz J, Brickner PW. Human immunodeficiency virus infection among homeless men in a New York City shelter. Association with Mycobacterium tuberculosis infection. Arch Intern Med 1990;150:2030-2036.

7. Hamrick RM 3rd, Yeager H Jr. Tuberculosis update. Am Fam Physician 1988;38:205-213.

8. Kisner DG. Tuberculosis. Missed opportunities. Arch Intern Med 1987;47:2037-2040.

4. PROBLEMS IN TUBERCULOSIS CONTROL - HUMAN IMMUNODEFICIENCY VIRUS

Mycobacterial infections, including TB, are well recognised complications of immunosuppression. A growing body of evidence indicates an association between infection with human immunodeficiency virus (HIV) and TB, that HIV infection is a risk for the development of TB.

While *Mycobacterium avian complex* is the most common species of mycobacterium isolated from people with acquired immunodeficiency syndrome (AIDS), *Mycobacterium tuberculosis*, with its capacity to affect people with normal immune systems, has the potential for more serious health consequences in the general community.

People with HIV infection may be more susceptible to TB for two reasons. Firstly, it may allow previously acquired latent infection to progress to disease. Secondly, immune deficiency secondary to HIV infection may cause increased susceptibility to new tuberculous infection which is then allowed to progress rapidly to overt disease. The former scenario is more likely given the clustering of cases around the time of AIDS diagnosis and the low rate of new infections in the general US population.

Diminished host tissue response results in more disseminated disease in TB-HIV coinfection,. The unusual clinical features emphasise the importance of considering a diagnosis of TB in persons with known or possible HIV infection, and a diagnosis of HIV infection in persons with TB.

BCG must not be given to immunosuppressed individuals.

Given the association of HIV infection and TB, communities with a high incidence of HIV infection are likely to experience an increase in the incidence of TB. This could result from an increase in the disease in AIDS sufferers due primarily to activation of latent disease, and in a small proportion, new infection. The resultant pool of infection could well lead to new cases in the HIV negative population depending upon the disease load in the HIV positive population,their infectivity and the amount of contact between the two groups.

Control of infection may be assisted by the prevention of TB in HIV positive patients with positive tuberculin reactions. The American Committee for the Elimination of Tuberculosis recommends that any person infected with HIV who has a tuberculin reaction of over 5mm should have isoniazid unless contraindicated for at least 12 months.

It is recommended that close monitoring of HIV patients for TB occur, particularly if tuberculin positive, and rapid treatment of disease is detected. To assist in these aims, all HIV positive patients should be given a tuberculin test and be offered prophylactic therapy if positive. Given the implications of HIV infection, and improved access to therapy for HIV positive people, HIV counselling and testing is recommended for all people with mycobacterial disease.

The National Health and Medical Research Council advises that before vaccination with BCG one must ascertain the absence of any HIV high risk behaviours. It is probably advisable to carry out HIV testing for all new cases of TB and people at high risk for HIV infection. All people with HIV infection should have a tuberculin test, and those with reactions of 5 to 10 mm should wither be followed closely or be offered isoniazid chemoprophylaxis for 12 months. Close follow up for HIV patients for TB is advised. Conversion to negative test may be an indication for chemoprophylaxis.

STRATEGIES

- All people with HIV infection should be offered a tuberculin test as early as possible.
- Those with tuberculin reactions greater than 5mm should be offered chemoprophylaxis.
- All persons with clinical AIDS, or other HIV related disease should receive a chest x ray and be examined for evidence of extra pulmonary TB, regardless of the tuberculin reaction.
- Active TB in HIV seropositive persons should be treated with conventional medications but for a longer duration - three months longer than for other patients, or a minimum of six months after sputum cultures become negative.

References

1. Centers for Disease Control. Tuberculosis and Human Immunodeficiency Virus Infection : Recommendations of the Advisory Committee for the Elimination of Tuberculosis (ACET). MMWR 1989;38:237-250.
2. Selwyn PA, Hartel D, Lewis VA, Schoenbaum EE, Vermund SH, Klein RS, Walker AT and Friedland GH. A prospective study of tuberculosis among intravenous drug users with human immunodeficiency virus infection. N Engl J Med 1989;320:545-550.
3. Sutherland I. The epidemiology of tuberculosis and AIDS. CDR 1990;10:3-4.
4. Plant AJ, Christopher PJ, Richards GA, Thomas M, Fox DG. The acquired immunodeficiency syndrome:a tuberculosis threat? Med J Aust 1988;148:609-615.

5. TARGETS AND JUSTIFICATION OF THE TARGETS FOR THE 'ELIMINATION' OF TUBERCULOSIS (TB)

Preamble:

'Controlling' tuberculosis is the process which leads to tuberculosis problem reduction.

The OBJECTS of TB "Control" are:

a. reduction of human suffering at the individual patient level and at the level of his/her microenvironment. - The medical/public health imperative;

b. reduction of the magnitude of transmission of tuberculosis within the community - the impact; the sociopolitical imperative.

The 'vision' is obviously that of a tuberculosis-free society and the 'mission' is to devise strategies to fulfil this vision (if possible).

It should however be reiterated that so far as the anti-TB program is concerned, no amount of "paper-planning" would have any real chance of success if State governments fail to heed advice based on the grim experience of many countries.

"Health economists do extrapolate our downtrends in TB to a (naturally expected) stage of elimination" and State Governments do tend to "eradicate programs or plans before the bug is eradicated". The former is simplistic and erroneous and the latter, to be resisted.

Commonsense and past experience with other communicable diseases would dictate the need for a growing centralisation as a disease declines, but almost " all States" surprisingly begin decentralization (unplanned or ill-conceived) with respect to TB as it declines!This is the main problem with TB control, here, in United States and in other industrialised countries.

The TB panel must acknowledge these realities in developing a strategic undertaking towards TB elimination at a national level. Failure to do this will make a mockery of these deliberations and a slight but significant slackening of TB downtrend will not be noticed and if noticed, will be wrongly interpreted.

Already there are media reports wherein our Health Minister in Canberra was seen to be taking a gratifying look at our national TB trends simply because they do not (yet) show the USA type of worsening! Our national statistics DO NOT lend themselves to such interpretation. If the Statewide reporting of relevant statistics is not adequate or not specific for such predictions then 'standardised' reporting should be adopted by the States. It is not appropriate to explain away these kinds of shortcomings in the national tuberculosis statistics by merely stating that CDI "depends on the professionalism of the States".

Background: Many countries in the "developed" world, including Australia, have noted a steady decline in the incidence of tuberculosis during this century, such that the prevalence of tuberculosis in these countries is now very low. Because of this, some of these countries are now developing strategies aimed at the elimination of tuberculosis (eg USA strategic plan'). Styblo' has pointed out that total eradication of tuberculosis is unlikely in the foreseeable future, this conclusion being based on current knowledge of the epidemiology of tuberculosis. Because of this, he has proposed intermediate targets to be achieved along the path towards total eradication* of tuberculosis, ie:-

(a) "close to eradication" ie incidence of sputum smear positive pulmonary tuberculosis of less than 1:1,000,000 population/year. This would be equivalent to prevalence of TB infection of % in the general population with risk of new infection being <0.002%/year.

(b) "virtual eradication", ie incidence of sputum smear +ve pulmonary TB of less than 1:10,000,000 population/year. This would be equivalent to prevalence of TB infection of <0.1% in general population with risk of new infection being <0.0002%/year.

It is important to emphasise that these targets are based on smear positive tuberculosis, this being the epidemiologically important form of tuberculosis with regard to transmission of infection. Whilst transmission has been reported by routes other than via aerosols formed by sputum smear positive tuberculosis sufferers, these are not of epidemiological importance. A corollary of this is that if collection of sputum is not undertaken or if sputum is not microscopically examined for presence of *M tuberculosis*, one cannot define whether or not the case is sputum smear positive or not.

Currently, the overall incidence of sputum smear positive tuberculosis in Australia is approximately 4:100,000 per year. As in other technically advanced countries, there has in Australia been a significant downward trend in the incidence of tuberculosis during this century, this downward trend predating the use of chemotherapeutic agents. Much of this downward trend has been due to changes in the microenvironment, which has become increasingly non-conducive to tuberculosis transmission. Australia is now at an "advanced stage" (see page S) of tuberculosis control. It is from this perspective that one can realistically discuss strategies aimed at virtual elimination' of tuberculosis, recognising that total elimination cannot be contemplated until there remains no infected person among the world's population. Therefore, total elimination can not occur within the next few generations using the currently available tools.

The most accurate method currently available for monitoring tuberculosis is to conduct "annual risk of infection" surveys. Unfortunately, these surveys are difficult to perform, can only give information regarding risk of infection in segments of the population in whom the surveys are conducted (it would be almost impossible to produce a sample population to measure the average annual risk of infection of the entire Australian population), and there is much difficulty in dealing with cross-reactivity due to other environmental mycobacteria and previous BCG vaccination. Because of these reasons, one needs to rely on morbidity data (although this does not provide us with the knowledge of r~n~ tuberculosis burden).

As notification of tuberculosis is the only source of morbidity data, it should be complete. Currently, and certainly in Queensland, the notification rate is believed to be an accurate reflection of the true incidence. Safeguards should be put in place to ensure that notifications remain complete. These safeguards could include use of the following:-

(1) laboratory notifications of all M *tuberculosis* isolates. Furthermore, any mycobacterial isolates that have not been speciated should also be notified;

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1. CDC, MMWR 1989; 38:55-3
2. Styblo K. Bull -UATLD, 1989;64(3):58-64

In this context, the descriptive terms "eradication" and "elimination" are used interchangeably in meaning. The TB working party (NHMRC) meeting on the 3rd April 1992 decided on using the word "elimination" for Australian deliberations and strategic planning.

(2) notifications by pathologists of all histological specimens suggestive of tuberculosis;

(3) Notifications by pharmacists of prescriptions for standard anti-tuberculous drugs.

Furthermore, as stated above, it is sputum smear positive pulmonary tuberculosis which epidemiologically is the most important. It is to be expected, based on the natural history of tuberculosis infection, that non-pulmonary tuberculosis incidence rates would decrease more slowly than those of pulmonary tuberculosis. One can therefore expect that the proportion of cases due to non-pulmonary tuberculosis will increase. Monitoring these forms of tuberculosis is an important method of surveillance of the awareness of the medical community of the possibility of tuberculosis as a cause of systemic disease. Similarly, sputum smear negative tuberculosis does provide a crude idea of the medical community's awareness of tuberculosis, as it is more likely to be sputum smear negative if diagnosed early.

This, however, is a rather simplistic characterisation. Adequacy of bacteriological diagnostic procedures and the sequence of such procedures need refinement and characterisation to enable accurate surveillance. With regard to the bacteriological status of tuberculosis cases in situations where diagnostic facilities are available (as is the case in Australia), previous studies would suggest that about 30% of pulmonary tuberculosis would be bacteriologically negative. Therefore, if bacteriologically negative TB is found in a significantly higher proportion than this one should consider the possibility of overdiagnosis or less efficient bacteriological procedures. Similarly, if a significantly smaller percentage of cases is found to be bacteriologically negative, then one must consider the possibility that medical practitioners are reluctant to make a diagnosis in the absence of bacteriological supportive evidence.

In the final analysis, of all the morbidity data it is the incidence of sputum smear positive cases which most accurately defines the epidemiological extent of tuberculosis. However, for this accurately to reflect the situation, the reliability of the data must be ascertained. It should be ascertained whether or not sputum has been collected before defining a case as smear positive or smear negative. Modern practice has resulted in tuberculosis more often being diagnosed only after invasive investigations, and some of these cases are defined as smear positive or negative on the basis of examination of tissues other than sputum. Whether or not sputum was examined to determine if a case was smear positive or negative should be ascertained. Finally, whether or not associated pulmonary tuberculosis was excluded in extra-pulmonary tuberculosis should be noted. Again, this should be specified, particularly as the incidence of tuberculosis declines.

DEFINITION OF TARGETS

Taking these factors into consideration the following targets may be set for strategic plans for the "elimination of tuberculosis", these being based on maintaining public health action plans which would allow the continued downward trend of incidence of tuberculosis in Australia:

GOALS/TARGETS All goals are essentially arbitrary and flexible. They are important because they give a sense of direction, improve surveillance and allow adjustment when necessary. Arbitrarily, good' tuberculosis control is what is noted in most Western countries, viz a steep downtrend at an annual reduction of TB "problem" of about 10%. Currently the annual TB morbidity rates as notified are <10:100,000. Recently USA in its TB Elimination plan suggested a target of less than 3:100,000 as their intermediate goal. In Australia, for the general population we already have similar rates and we call this an **"advanced stage"** of TB control. It should be the expected aim of most of the States in Australia to register notification rates of <3:100,000 by the year 2000.

FUTURE GOALS

1. **Intermediate goal,** ie 2-3 cases of sputum smear positive pulmonary tuberculosis per million (1,000,000) of population each year - target date 2010.

2. **Close to elimination goal,** ie 1 case of sputum smear positive pulmonary tuberculosis per million (1,000,000) of population per year - target date 2015-2020.

3. **Virtual elimination goal,** ie one case of sputum smear positive pulmonary tuberculosis/per ten millions (10,000,000) of population per year - target date 2030-2040.

These targets are based on the following assumptions:-

(a) that tuberculosis notification rates for Australia in 1991 were as reported in Vol. 16, No. 19 CDI, wherein it was noted that incidence of tuberculosis as judged by notification rate in 1991 was 5.21:100,000, and that 626 of the total of 903 notifications were of pulmonary disease.

(b) that the information contained in that CD~ report was an accurate reflection of the tuberculosis situation in Australia in 1991.

(c) that sputum smear positive pulmonary tuberculosis constitutes about 50% of the total pulmonary tuberculosis cases, this assumption being based on the Queensland experience, as well as information available from published reports of other countries.

(d) that Australia can maintain a decline in TB incidence of approximately 10% per annum.

Any accelerated rate of decline would be fortuitous but if sought through intensification of 'control' strategies these should be cost-effective to justify such measures against other priority health goals.

Separate goals and surveillance should be in place for subsegments of our population which carry a higher burden of TB. As a rough guide these targets of the two major subpopulation could be:-

1. **For the indigenous Australians** - a goal prior to the Intermediate goal (call it appropriately a PRIORITY GOAL) of TB incidence of smear positive cases each year of less than 5 per 100,000 by the year 2000.

2. **For migrants** from countries with 'high' TB incidence: A monitored decelerating rate of tuberculosis notification of new cases of smear positive TB each year to be no greater than twice the average Australian rate within 5 years of their settling in the country.

Specific and variable goals should be planned for many other specific problem areas (Multidrug Resistant TB, Nosocomial TB, AIDS and TB etc.) through established guidelines on their specific surveillance.

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References

1. Surveillance Systems and Public Health Priority Actions L. Trnka et al, Bull IUATLD 1990,65(1):37

2. Tuberculosis Epidemiology and Surveillance A. Schillberg (Gemmany) - 40 B. Watson (UK) - 42 C. Aoki aapan) -44 D. Sharbaro (USA) - 47 E. Styblo (Netherlands) - 49 J 1990, Bull IUATLD 65(2-3)

3. Maintenance of a TB program in Elimination Phase - Broekmas Bull IUATLD 1990, 65(2-3):92

4. Surveillance of tuberculosis in low prevalence countries where TB is in decline M. Aoki, Bull IUATLD 199166(4):201.

5. Early diagnosis of tuberculosis by fibroptic bronchoscopy H. Fujii et al, 1992. Tubercle and Lung Disease 73(3):167.

6. Misbehaviour of a dying epidemic - Rieder 1992, Tubercle and Lung Disease - 73 (4):181

7. Elimination of tuberculosis from Europe and the World - Tala and Kochi Eur. Resp. J, 1991; (4):1159

8. Tuberculosis elimination in the Countries of Europe and other industrialised Report on WORKSHOP jointly by IUATLD (European) and WHO. Eur. Resp. J., 1991(4):1288

9. Problems of Tuberculosis in Decline N.W. Home BMJ 1984; 288 (6426):1249

10. TB - Foreign bom (USA) MMWR 1990; 39(No.RR-18): 1-21

11.Prevention and Control of TB in Migrant Famm Workers (USA) MMWR 1992, 41(No.RR-10):1-14

6. RESEARCH/SERVICE EVALUATION IN TUBERCULOSIS

"Research in TB as elsewhere may solve specific problems, stimulate interest or improve precision."

Research in tuberculosis can be undertaken at differing levels. Certain types of research can only be carried out by highly specialised institutions or need to be done in a collaborative setting, either between States or between Australia and other countries. Obviously, research at this level requires extensive planning and availability of both]human and material resources. Such research can only be done as resources allow, and it is up to individual State TB services to decide to what extent they wish to be involved in i:he type of research, and to communicate with research units that may be able to carry out specialised scientific research. However, some of this basic' or wide based applied' research could be carried out only through corroborative studies or through international participation, at this stage.

Research should also involve **"in-sevice evaluation".** It is this area of research to which all State TB services should contribute if Australia has any aspirations of e liminating tuberculosis. It is crucial that all aspects of tuberculosis services should be monitored. If elimination of tuberculosis is to be achieved, one should be as certain as possible that all cases of tuberculosis are notified. This should be part of the evaluation.

The evaluation should answer the following questions:-

1. Which segments of the population should be targeted for tuberculosis screening exercises? How can these segments be most effectively screened? These questions can only be answered if the tuberculosis statistics are accurate and include certain essential demographic characteristics. Essential demographic information for the entire population should also be available, and it is important to ensure that essential information is gathered in census statistics. Important groups that should be investigated and monitored include recent immigrants, indigenous Australians, the homeless, institutionalised persons, health care workers (HCWs) and the aged. Further information could be obtained by surveys attempting to define and monitor the incidence of TB infection in groups that could pose problems for tuberculosis control in the future (eg. those at risk for HIV infection). Similarly, trends and magnitude of nosocomial infections and multi-drug resistant M *tuberculosis* (MDR MTB) should be closely monitored.

2. What is the effectiveness of tuberculous contact tracing exercises? Who are the contacts most at risk and what is the most cost-effective screening and surveillance method? This again requires good data collection and good longitudinal follow-up studies.

3. How much overlap is there between HIV infection and tuberculosis infection? It is important that this situation be closely monitored. HIV has had a major impact on tuberculosis programmes in some parts of the world. This impact depends on the extent of the HIV epidemic and the degree to which those at risk for HIV infection are also at risk for tuberculous infection. (see 11)

4. Are there significant delays in diagnosis and treatment of tuberculosis and to what extent can this be remedied? To obtain this information, data is required to determine both patient-associated delay (ie delay in a symptomatic person presenting to medical services) and delay associated with medical services, ie delays in diagnosis and commencement of treatment once patients have presented to medical services. The reasons

for delays should be ascertained and this information should be used to organise programs with an aim to correcting any deficits.

5. Does the treatment of tuberculosis comply with current accepted standards? This requires collecting data not only on the actual drug treatment used and whether or not drugs were correctly prescribed, but also data on monitoring of therapy. Such data should include evaluation of patient compliance (with evaluation of both the actual compliance of the patient in taking medication as prescribed and the continued monitoring of compliance by medical services). Data should also be collected of the monitoring of bacteriology during treatment, as it is the bacteriological response that is most important in determining the long term success of therapy. Reasons for default from therapy and lack of compliance should be sought and evaluated and any measures that may improve compliance should be carefully evaluated both for success and for acceptance by patients.

6. To what extent does tuberculosis contribute to avoidable deaths? Information should be carefully assessed to decide to what extent tuberculosis has contributed to death in persons dying with untreated tuberculosis. If tuberculosis did contribute to death, the reasons for this should be ascertained, particularly if there has been significant diagnostic delay or, especially, if tuberculosis was only diagnosed post-mortem. More efforts should be made to encourage post-mortems in persons dying of "pneumonia" where a definite aetiology was not found during life.

7. Is the general medical community sufficiently aware of the possibility of tuberculosis as a diagnosis in an individual patient, or as a potential complication of newer forms of therapy? How often are people assessed for tuberculous infection before being given immunosuppressive therapy? This information can be gleaned by monitoring routine practices carried out in a variety of medical settings. Information obtained from such studies can be used to target the most appropriate audience for future education campaigns.

8. What is the role and efficacy of chemoprophylaxis? Is it acceptable to the target population? What is the compliance rate? These questions are important if chemoprophylaxis is going to feature in a public health campaign. One needs to know if it is effective as part of a program, and for which patient group it is most effective. One also needs to be aware of any inherent weaknesses of such a program, so that efforts can be made to improve the delivery of this service and that the resources required to ensure the success of the program are available.

9. If Mantoux Tests are routinely performed on any population subgroups, what is the annual risk of infection? The method of determining annual risk of infection has been well set out by various authors. This information gives the most accurate assessment of the current status of TB control using currently available methodologies. More importantly, tuberculin testing raises a number of operational issues requiring evaluation.

10. What is the yield and cost effectiveness of current screening procedures? This relates to the first question. It needs to be answered to justify procedures now carried out, particularly as the public purse becomes tightened. (See Attachment A).

11. RESEARCH NEEDS FOR FURTHER CLARIFICATION OF "AIDS" AND MYCOBACTERIA RELATIONSHIP

1. Infectivity of Patients with Dual Pathology:

(a) of MTB and HIV

(b) of aerosol transmission of MTB in AIDS

(c) of HCWs and nosocomial MTB transmission

(d) of MDR MTB infection and disease

2. Clinical pattern of TB altered by HIV/AIDS

3. Diagnostic criteria of:

(a) TB infection particularly during cellular immunodeficiency

(b) TB disease if Occult'

4. Effect of HIV/AIDS on response to treatment of:

(a) associated TB infection

(b) TB disease ie efficacy of usual CP' OR CT'

5. Longitudinal studies:

(a) to determine CP or CT results

(b) to determine the true rate of TB (and AIDS) among doubly infected persons

(c) Intervention studies

12. Lancaster in Australia preceded Springett (UK) and Grzybowski (Canada) in conducting "cohort studies in Tuberculosis". No recent similar studies have been conducted here. There is scope in conducting specific cohort' studies in TB (eg changing pattern of development of TB de novo' in cohort of migrants).

As stated in the introduction, there are other areas of research in tuberculosis which cannot be carried out by all tuberculosis services. Some of these require collaboration with other organisations or specialised facilities. These include:-

(1) Immunologic studies aimed at producing

(a) improved tests for detecting TB infection; and

(b) candidate vaccines that are both as safe as and more effective than BCG;

(2) New methods of treatment of tuberculosis, including research into newer drugs and use of immunomodulators, either or both of which may shorten chemotherapy. Obviously, patient numbers in Australia would not be sufficient for treatment trials, but collaboration with other countries could be sought.

(3) Newer diagnostic techniques could be developed or assessed. The aim of such research would be to, firstly, provide more rapid laboratory confirmation of tuberculosis, and, secondly, to improve the sensitivity of currently available cultural techniques without significant loss of specificity.

(4) Characterisation and usefulness of DNA amplification techniques in diagnosis and management of tuberculosis.

(5) In summary most of the essential service based research revolves around the fundamental principles of "mass case finding" and "treatment" (see Attachment B). The proportion of active cases discovered each year and the proportion placed on chemotherapy, completing the same and being cured of infectious tuberculosis, have a multiplicative impact on the transmission of tuberculosis in the community. Any positive impact against the acid fast bacillary transmission of less than 90% is not acceptable in an industrialised country like Australia. Impacts well above these are required for a sustained reduction of tuberculosis problem towards its elimination.

While only some of the inservice evaluation research can be done on a national basis in Australia, many of these and a few basic research items have the potential of state based development. This general survey can only hope to stimulate such interest.

References

1. Basic Research and Tuberculosis Elimination programmes:

A. Granges; 19

B. Rook et al; 23 1990; Bull IUATLD 65(2-3),

C. Hanford et al; 27.

2. TB Elimination in Industrialised Countries Report IUATLD (Europe)/WHO 1991; Erop. Resp. J. 4: 1293-1295.

3. IUAT/WHO - Proposals for Research in TB A. TSR-671:21-1981.

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Bibliography

McAnulty J, Levy M, Thomas M. Rubin G. Review of Tuberculosis in NSW; NSW Health Department discussion paper 1991.

Centers for Disease Control. A Strategic Plan for the Elimination of Tuberculosis in the United States. MMWR 1989, 38 (supp no. S-3).

Farer LS. Chemoprophylaris. Am Rev Resp Dis, 1982;125:102-107.

American Thoracic Society, Medical Section of the Lung Association. Control of Tuberculosis. Am Rev Resp Dis 1983; 128: 336-342.

Mukerjee CM. Reactivation of Pulmonary Tuberculosis in New South Wales 1975. MJA Sept 23 1978; 333-335.

National Health ant Medical Research Council. Tuberculosis in Australia and New Zealand into the 1990s. Australian Government Publishing Service, Canberra, 1989.

Hoolahan L, Levy MH. The prevalence of mycobacterial infection and conversion to BCG, New South Wales 1991. NSW Health Department, unpublished, 1991.

AIperstein G. Preliminary report to the NSW Tuberculosis Advisory Committee, August 1992.

Alperstein G. Screening of high risk population groups for tuberculosis infection. Discussion paper prepared for the NSW Tuberculosis Advisory Committee, 1991.

Reider HL. Tuberculosis in an Indochinese Refugee Camp: Epidemiology, Management and Therapeutic Results. Tubercle 1986; 66:179-186.

Centers for Disease Control. Screening for Tuberculosis and Tuberculosis infection in High-Risk Populations; The Use of Preventive Therapy for Tuberculosis infection in the United States - Recommendations of the Advisory Committee for the Elimination of Tuberculosis. MMWR 1990; 39 / No. RR-8.

Comstock GW, Livesay VT, Woolpert SF. The prognosis of a positive tuberculin reaction in childhood and adolescence. Am J Epidemiol 1974; 99: 131-138.

Farer LS. Chemoprophylaxis. Am Rev Resp Dis 1982; 126: 102-107.

Centers for Disease Control. Prevention and Control of Tuberculosis in U.S. Communities with At-Risk Minority Populations and Prevention and Control of Tuberculosis Among Homeless Persons. MMWR 1992; 41/ No. RR-5.

Levy M, Nagrahi S. Tuberculosis among Indochinese refugees - New South Wales -1990-1991. NSW Health Department 1991.

Bek M, Levy M. A Review of Refugee Screening in NSW. NSW Health Department 1991.

Subcommittee of the Joint Tuberculosis Committee of the British Thoracic Society. Control and Prevention of Tuberculosis in Britain: an updated code of practice. BMJ 1990; 300: 995-999.

Braun M. Truman BI, Maguire B, et al. Increasing incidence of tuberculosis in a prison inmate population. JAMA 1989; 261: 393-397.

Centors for Disease Control. Prevention and Control of tuberculosis in facilities providing long term care to the elderly: Recommendations of the Advisory Committee for the Elimination of Tuberculosis. MMWR 1989; 39/ No. RR-10.

Greenberg PD. Lax KG. Schechter CB. Tuberculosis in House Staff A Decision Analysis Comparing the Tuberculin Screening Strategy with BCG Vaccination. Am Rev Resp Dis March 1991; 490-496.

Advisory Committee for the Elimination of Tuberculosis (ACET) (1989). Tuberculosis and Human Irnmunodeficiency Virus Infection: Recomendations of the Advisory Cornmittee for the Elimination of Tuberculosis. MMWR; 38/ No 14.

Price LE. Rutala WA, Samsa GP. Tuberculosis in Hospital Personnel. Infect control 1987; 8: 97-101.

Aitken ML Anderson KM, Albert RK Annual Tuberculosis ScreeniDg of Hospital Employees: an idea lacking supporting data. Am Rev Resp Dis 1988;138:31.

NSW Tuberculosis Advisory Committee, 1991.

Golberg HF, Pigott P. HIV Disease, TB Disease and their Association. Working paper for the TB Advisory Committee of NSW, 1991, NSW Department of Health.

AIperstein G, Isaacs D and Mellis C. Working Paper for the TB Advisory Committee of NSW. NSW Department of Health, 1992.

Infectious Diseases Section, Epidemiology and Health Services Evaluation Branch. Infectious Diseases Manual. NSW Department of Health, 1992.

Wharton M, Chorba TL, Vogt RL, Morse DL, Buehler JW. Case Definitions for Public Health Surveillance. MMWR 1990; 39(RR-13):143.

World Health Organization Tuberculosis Unit. Tuberculosis Surveillance and Monitoring - Report of a WHO Workshop; Geneva, 20-22 March 1991.

Centers for Disease Control. Tuberculosis database 1991.

Rouillon A, Pertrizet S, Parrott S. Transmission of Tubercle Bacilli: The effects of Chemotherapy. Tubercle, 1976; 57: 275-299.

Pang S C, Clayton A S, Harrison R H. Culture positive tuberculosis in Western Australia. Aust NZ J Med 1992; 22:109-113.

WORLD HEALTH ORGANIZATION, TUBERCULOSIS CONTROL PROGRAMME.

NATIONAL TUBERCULOSIS CONTROL PROGRAMME (NTCP) DATABASE.

1 PROGRAMME MANAGEMENT

1.1 Name/address of NTCP Director :
There is no national director of Tuberculosis in Australia. There are State or Territory Directors located within each State or Territory (see attached).

1.2 Does a Central Tuberculosis Unit exist in the Ministry of Health?
Each State/Territory has a central TB Unit (see attached).

1.3 Is TB Control Programme integrated with other programme (eg leprosy)?
Yes, usually with communicable diseases programme.

2 EPIDEMIOLOGY

2.1 Average estimated annual risk of infection (ARI) : 0.05% Year : 1991
(based on the assumption of 1% of ARI equals 50 smear positive pulmonary cases per 100,000. In 1991, Australia has 447 cases of culture positive pulmonary cases).

2.2 Tuberculosis Notifications and Deaths

	Year	Number	Rate/100,000
Total notified TB cases (all forms*) :	1991	951	5.48
Total TB Deaths	1990	63	0.36

*New cases of M Tb plus Relapses, does not include Atypical cases

2.3 HIV seropositivity among TB cases :
National data not available, but data from NSW and WA are presented.

(1) NSW

HIV seropositivity among TB cases : 20.2% Year : 1991
Source : NSW TB Database
Method : All notifications of M Tb and Atypical Disease. 10 cases of M Tb and 114 cases of Atypical Disease had HIV seropositivity.

(2) WA

HIV seropositivity among TB cases : 0.4% Year : 1985 - 1992.
Source : WA notification of HIV and TB cases

3 CASE FINDING

3.1 Most recent case reporting (number and percentage of all cases) :
Year 1991

	Total cases (All forms)	New Sptuum Pul +ve	New Sputum Pul -ve	New Extra-Pulmonary	Relapses
Number	951	447	178	282	44
Percentage	100	47	18.7	29.6	4.6

3.11 Most recent reporting of new sputum positive pulmonary cases (number) by sex and age :

	0-4	5-14	15-24	25-34	35-44	45-54	55-64	>65	Unk*	Total
Males	2	2	20	39	38	35	41	87	11	275
Females	4	3	32	31	21	9	11	55	6	172
Total	6	5	52	70	59	44	52	142	17	447

*Unknown

3.1.2 Most recent reporting of new sputum negative pulmonary cases (number) by sex and age :

	0-4	5-14	15-24	25-34	35-44	45-54	55-64	>65	Unk*	Total
Males	2	5	5	13	15	10	15	29	4	98
Females	5	4	8	10	10	8	3	10	2	60
Total	7	9	13	23	25	18	18	39	6	158

*Unknown

3.1.3 Most recent reporting of new extrapulmonary cases (number) by sex and age :

	0-4	5-14	15-24	25-34	35-44	45-54	55-64	>65	Unk*	Total
Males	8	3	17	20	15	10	18	35	2	128
Females	4	7	11	38	23	24	14	27	6	154
Total	12	10	28	58	38	34	32	62	8	282

*Unknown

3.2 How many TB patients remained on the TB Register at the end of the most recent year?
There is no national TB Register. National surveillance detects new cases only. Therefore data on incidence of new notifications are analysed.

3.3 Does a TB Reference Laboratory exist?

Yes. Australia has five TB Reference Laboratories. They exist at the following locations :

1 Laboratory of Microbiology and Pathology, Queensland Department of Health, Brisbane, Queensland.
2 Institute of Clinical Pathology and Medical Research, Westmead Hospital, Westmead, New South Wales.
3 Clinical Pathology Department, Fairfield Hospital, Fairfield, Victoria.
4 Institute of Medical and Veterinary Science, Adelaide, South Australia.
5 State Health Laboratory Services, WA Department of Health, Perth, Western Australia.

If yes, what are its functions (quality control, training, culture, sensitivity testing, etc)?

All of the above.

3.4 Estimated case finding coverage rate : 100% Year : 1991

No exact details are available, but it is estimated that due to extensive and comprehensive contract tracing, case finding coverage rate is 100%. One study in Western Australia, describes the sources of case detection between 1986 - 1990 as :

Migrant surveillance	36.8%
Symptom presentation	39.8%
Incidental	7.5%
Chest X Ray follow up	3.8%
Employee Chest X Ray	1.8%
Contact examination	0.4%
Autopsy	2.6%
Others	7.3%

4 PREVENTION

4.1 BCG

Routine BCG for school age children has been phased out in Australia. It is now indicated for specific high risk groups only. No national data exist in this area. One study in Western Australia has resulted in the following information.

Target group	Coverage (%)	Year
Infants (<1year old)		
Babies of refugee migrant from South East Asia	95	1991
Other age group (please specify)		
- Newborn of Aboriginal mothers	Unknown	1991
- Contact of cases < 17 years	85	1991
- Tertiary students in health sciences	Unknown	1991

4.2 Preventive chemotherapy with Isoniazid (INH)

4.2.1 Is preventive chemotherapy used by the TB Control Programme?
Yes

4.2.2 If yes, please describe :

(1) the policy in terms of target groups and duration of administration.
In general, chemoprophylaxis is given to people who are recent tuberculin converters, especially children and teenagers and contacts who react strongly to tuberculin testing. In practice, this usually means migrants, under 35 years old from high prevalent countries, with a positive tuberculin test, no BCG vaccination previously and with normal chest x rays. INH is usually given for 6 months.

(2) and the outcome, such as number of persons who receive it and completion rate.
No national data exist on this, but in WA, in 1991, there was a completion rate of 85%.

5 DRUGS AND TREATMENT

5.1 Latest drug procurement for NTCP : Year : 1991

Drug procurement in Australia is not centralised. Drugs are procured as part of a State/Territory Health Department procurement of drugs. No separate budget exist from a national perspective. No national data exists

on drug procurement, and a recent survey for WHO is attached. From a State perspective, I've enclosed data specific for WA.

Anti TB Drugs	Dose Quantity	Unit Per unit	Price(A$) Quantity	Total Cost(A$)	Total
Ethambutol	400mg	100	37.00	310	11,470.00
Isoniazid	100mg	100	9.90	200	1980.00
Pyrazinamide	100mg	100	2.00	1100	2200.00
Rifampicin	300mg	100	16.50	450	7425.00
	150mg		9.00	140	1260.00
Streptomycin	gm	100		160	No charge
Water for inj.		10	1.00		15.00
Others:					
Clofazimine	100mg	100	13.90	120	1688.00
Cycloserine	250mg		118.00	11	1298.00
Azetionamide	250mg	100	15.00	72	1080.00

Note: Above medications required for patients notified in 1991 ie 83 cases of M Tb, 17 cases of NTM plus other "Atypical" patients already on treatment and 68 patients on chemoprophylaxis. Doses are standard doses as recommended by the WHO.

5.2 If blister packages are used, please specify combinations below :
Not used.

5.3 Are anti TB drugs provided to TB patients only through NTCP?
Not through a national programme. Through the State/Territory programme, via hospital pharmacy or through private pharmacy if private patient.

If not, from where (including private pharmacist)?
Through hospitals, private pharmacists if patient is a private patient. Occasionally drugs are brought in overseas.

5.4 Treatment

5.4.1 Currently used regimens:
Based on sensitivity test results and is individualised. Usually, 2RHEZ - 4RH

5.4.2 What is the percentage of newly diagnosed sputum positive pulmonary cases treated by short course chemotherapy:

100% Year : 1991

5.4.3 Describe how the regimen is administered (ie hospitalisation, direct supervision,self administered etc)

i) During the initial phase.

Various methods, depending on patient and circumstances, including :

(1) self administration with regular home visits by nursing staff.
(2) hospitalisation to initiate therapy
(3) direct supervision.

ii) During the follow up phase

Usually by direct supervision or self administration with regular home visits by nursing staff..

5.4.4 Most recent cohort analysis results of new sputum positive cases (numbers and percent).

i) data not available
ii) data not available

6 ADDITIONAL INFORMATION

6.1 Donors and other agencies assisting NTCP and type and amount of assistance.
NIL

6.2 TB Research Projects

Includes :

(1) The Australian TB Project - DNA typing of Mycobacteria, conducted at the Fairfield Hospital, Melbourne, by Dr Brian Dwyer.
(2) An evaluation of screening processes in migrants with TB, conducted at the Communicable Diseases Section.
(3) Preliminary studies into identifying exposure to M Tb through blood analysis, by the CSL, Melbourne.
(4) Other individual projects, through academic institutions.

6.3 Other important persons connected to the control of TB in the country.

See attached list of TB Directors.

6.4 Sources of information used in completing this form :

(1) Statistics kept by the Perth Chest Clinic, WA.
(2) NSW Tuberculosis Register.
(3) National TB Database
(4) Bennett S, Stevenson C, Melville G, de Looper M & Wright P (1992) *Mortality Surveillance, Australia 1979 - 1990*. Australian Institute of Health and Welfare : Mortality Surveillance Series, No 1, AGPS, Canberra.
(5) National Health and Medical Research Council. Tuberculosis in Australia and New Zealand into the 1990's. AGPS, Canberra, 1989.

PROFORMA FOR MUTUAL ASSISTANCE PROGRAMME

NAME OF THIS COUNTRY : **AUSTRALIA**

1 DEMOGRAPHIC DATA

1.1 Area :
7,682,300 Km sq.

1.2 Population :
17,335,933 (Estimate, June, 1991)

1.3 Population Density :
0.4 Per Km sq.

1.4 Age and Sex distribution of the population :
Estimate June 1991

AGEGROUP	MALE	FEMALE	TOTAL
0 - 4	651,386	619,801	1,271,187
5 - 9	649,536	618,713	1,268,249
10 - 14	633,686	601,433	1,235,119
15 - 19	699,978	666,080	1,366,058
20 - 24	717,456	690,861	1,408,317
25 - 29	708,071	693,911	1,401,982
30 - 34	721,051	710,962	1,432,013
35 - 39	668,319	666,876	1,335,195
40 - 44	664,753	645,662	1,310,415
45 - 49	530,459	502,451	1,032,910
50 - 54	433,475	412,040	845,514
55 - 59	369,381	359,336	728,717
60 - 64	365,520	365,543	731,063
65 - 69	321,094	354,931	676,025
70 - 74	227,235	281,763	508,998
75 - 79	159,940	228,937	388,877
80 - 84	86,711	148,304	235,015
>85	45,862	114,417	160,279
TOTAL	8,653,912	8,682,021	17,335,933

1.5 Birth rate :
15.4 per 1,000 of mean resident population as at year ended 31 Dec. 1990

1.6 Death rate :
7.0 per 1,000 of mean estimated resident population

1.7 Rate of increase of population :
1.47 % increase in 1991 (from 1990)

1.8 Infant mortality rate :
8.2 per 1,000 live births

1.9 Ethnic composition :
Ethnicity is not defined by the Australian bureau of Statistics. Population is recorded by country of birth.

1.10 Literacy :
100 %

1.11 Per capita income :
Aus $ 17624 (Australian Bureau of Statistics, 1991)

2 EXTENT OF TUBERCULOSIS PROBLEM

2.1 Prevalence of infection :
National surveillance have data on incidence cases only.

2.2 Risk of infection :
Estimated to be between 0.03 and 0.05% per year.

2.3 Prevalence of Tuberculosis (separately for pulmonary Tuberculosis sputum positive, pulmonary tuberculosis sputum negative and extra pulmonary tuberculosis)
Data not available.

2.4 Incidence of Pulmonary Tuberculosis (separately for sputum positive and sputum negative pulmonary tuberculosis) :

Data for 1991 :

No. cases (Pulmonary) = 715
No. cases (Extrapulmonary) = 162
No. total cases = 877
% Pulmonary cases = 67.7%

Total sputum positive cases = 594
% of sputum positive cases in pulmonary : 83%

2.5 Mortality rate :
0.4 per 100,000 (1985)

2.6 Is Tuberculosis notifiable by Law? :
Yes

2.7 Age and Sex morbidity rate if the disease is notifiable :
(see attached)

2.8 Number of TB clinics (separately for government and non government clinics) :
Varies from State to State and under State jurisdiction. Data not kept by the Commonwealth Department of Health, Housing and Community Services.

2.9 Indoor beds (separately for government and non government institutions) :
Beds for Tuberculosis are integrated into the hospital health services.

3 NATIONAL TUBERCULOSIS CONTROL PROGRAMME (NTP)

3.1 Is Tuberculosis control an entirely vertical or entirely horizontal programme? If not entirely, up to what level is it vertical and/or horizontal?
Tuberculosis control program is a State Health responsibility. Some States have a separate Tb program eg NT, Qld. Some State programs are integrated into general hospital/health programs eg Tas.

3.2 Number of doctors (generalists and chest specialists separately) :
Number of doctors are dependent on the State health service structure. In general, Chest Physicians with an expertise in Tuberculosis treat Tb patients in major hospitals in Australia.

3.3 Brief description of the modalities of NTP
(1) At the national level The Tuberculosis Working Party, under the auspices of the National Health and Medical Research Council, is working on a document for the elimination of Tb in Australia.
(2) The Communicable Diseases Section of the Commonwealth Department of Health, Housing and Community Services provides surveillance of Tuberculosis in Australia. Two surveillance systems have been created - a notifiable case reports system and a Laboratory based system to monitor drug resistance patterns.
(3) Yearly meetings take place with state Tb program managers/specialists to share data and to discuss relevent issues.

3.4 Is there any health insurance scheme? :
The Medicare scheme is a universal health insurance scheme covering all Australians.

3.4.1 Does the insurance cover the treatment expenses entirely or partly? Give details.
The Medicare scheme covers all aspects of treatment in hospital for tuberculosis, including cost of investigation, treatment and hospital bed.

3.4.2 Is the insurance scheme operated by general practitioners or only by specialists?
The insurance scheme is operated by general practitioners and specialists.

3.5 Are TB patients given any sickness allowance or benefit?
Tb patients can get a sickness benefit through Social Security.

3.5.1 Give details of benefit, if available in cash or in kind :
Benefit is in cash according to a defined schedule.

3.5.2 Source of allowance (government or voluntary organisations)
Government levied taxes support the sickness benefit scheme.

4 VOLUNTARY ORGANISATIONS

4.1 Number of voluntary organisations helping in the programme apart from National Tuberculosis Association :
Various local community groups, according to locality. No recognised official organizations.

4.2 Are the various voluntary organisations working independently or in collaboration with the Tuberculosis Association?
Independently.

4.3 Functional relationship between the voluntary organisations and the governmental programmes.
Advice according to needs. Communicable Diseases Section in contact with Voluntary organisations according to demand.

5 FUNDING

5.1 Estimated expenditure incurred by the Government on NTP
NTP not funded separately. Expenditure tied to State apportionment of health funds.

5.2 Estimated expenditure incurred by the National Tuberculosis Association including its affiliates/branches in the entire country.
Dr Harris to provide data.

5.3 International Assistance
Nil

5.3.1 Assistance in cash
Nil.

5.3.2 Assistance in kind (specify under separate heads e.g. drugs, equipment, personnel, etc)
Nil.

6 CASE FINDING

6.1 Current policy (whether active pr passive case finding) If both, what is the main pattern separately for urban and rural population?
Active case finding even in rural areas.

6.2 Method of diagnosis (sputum alone, sputum and x-ray, x-ray and clinical findings)
In combination, whichever is appropriate.

6.3 Are facilities for culture available? If so, what policies are followed in respect of culture of sputum negative specimens for diagnosis?
Yes, through the Tb Reference Laboratories.
Dependent on individual Chest Clinic policies.

6.4 Are facilities for sensitivity test available? If so, is sensitivity test done as a routine for all positive cultures or some selective procedure is applied?
Yes.
Yes, sensitivity testing is done routinely for all positive cultures.

6.5 Percentage of sputum smear positives to total pulmonary cases diagnosed?
67.7%

6.6 Prevalence of drug resistance
Data not available.

6.6.1 Initial drug resistance separately for all drugs

Drug resistance patterns in 1990

One drug only	% of total isolates
Streptomycin	5.7%
Isoniazid	3.9%
Rifampicin	1.9%
Ethambutol	0.3%

Resistance to at least one drug ie S,H,R or E is 11.8%

6.6.2 Acquired drug resistance separately for all drugs
Data not available.

6.7 Availability of microscopes. Are these manufactured in the country or imported? If both, the approximate percentages.
Microscopes are routinely available in all major laboratories.

6.8 Are adequate facilities available for repairs of microscopes? (separately for urban and rural areas)
Yes.

7 CASE HOLDING

7.1 Current policy
Policy dependent on individual state.

7.1.1 Is the treatment fully supervised/fully unsupervised/partly supervised :
Fully supervised.

7.1.2 Policy regarding hospitalisation. Is every sputum positive patient admitted initially for starting treatment?
No, dependent on individual case and physician.

7.1.3 Criteria for hospitalisation
Dependent on individual case and physician.

7.1.4 Are there any mobile clinics? If so, how is their function integrated with static institutions in respect of case finding and case holding?
Mobile clinics are available in very remote parts of Australia. These mobile clinics are still supervised by the State Tb Directors.

7.1.5 Drug delivery system (separately for urban and rural areas)
Aligned with the provision of health services, dependent on where the patient is. Public hospital patients are provided with free drugs. Private patients have to pay a small levy. Drugs in Australia are covered by the Pharmaceautical Benefits Scheme.

7.1.6 Is short course chemotherapy available all over the country? If not, approximate percentage of population treated by CC/conventional drug regimens :
Method of treatment depends on the physician in charge of the case.

7.1.7 Are drugs supplied free of cost to all patients in the country for the entire duration? If not, give details :
It depends on where they are. In the rural sectors, drugs are usually given free. In city areas, patients may have to pay a small fee, if they get the drugs through a chemist.

7.2 Anti TB Drugs

7.2.1 Are anti TB drugs imported/produced in the country itself? If both, relative percentage of each :
Imported.

7.2.2 Is the drug supplied adequate for the needs of the country?
Yes.

7.2.3 Are any drug regimens specified under the NTP? If so, please mention these.
Not specifically, although most physicians would use a standard regime.

7.2.4 Are treating physicians required only to prescribe specified regimens or they can prescribe regimens of their own liking?
They can prescribe whatever regimes they feel is appropriate for the patient.

7.3 Drug default

7.3.1 What percentage of patients complete treatment as per schedule (separately for urban and rural areas)
Data not available at the national level.
Individual state would have the data.

7.3.2 What is the usual regularity of drug taking?
Drugs are taken with regularity under supervision.

7.3.3 Is there machinery for monitoring and identification of drug default? If so, please give brief details :
The monitoring of drug defaulters is by the State program managers. Details are availabe through the State Health Departments.

7.3.4 Is there machinery for retrieval of drug default? If so, please give brief details.
The retrievel of drug defaulters is the responsibility of the State program managers. In general, a method do exist for retrievel of drug defaulters.

8 BCG AND CHEMOPROPHYLAXIS

8.1 Source of BCG
Commonwealth Serum Laboratory, Melbourne.

8.2 Is BCG available in sufficient quantity?
Yes.

8.3 Type of vaccine used
Dried live vaccine.

8.4 Methodology of vaccination
Intradermal.

8.4.1 Is vaccination through EPI/Separate BCG technicians/Both
Separate BCG technicians, usually specially trained TB sisters.

8.4.2 Is BCG limited to new borns only or higher age groups are also vaccinated? If so, give the age group up to which vaccination is usually made available
BCG is not routinely given in school children. BCG is only offerred to persons at risk who are tuberculin negative.

8.5 BCG coverage obtained in one year old children
Data not available.

8.6 Is chemoprophylaxis made available as a mass programme? If so, give details of age groups covered, criteria of chemophophylaxis, drugs prescribed, duration of chemophrphylaxis and regularity attained
No. Only in suitable situations.

9 TRAINING OF PERSONNEL

9.1 Training of doctors :
(1) Training in association with specialist medical training in Thoracic Medicine of the Royal Australian College of Physicians.
(2) Training in epidemiology at Masters level, in conjunction with the National Centre for Epidemiology and Population Health, Canberra, ACT.

9.1.1 Facilities for formal training of specialists :
(1) Royal Australian College of Physicians.
(2) Thoracic Society
(3) Various university institutions in the training of epidemiology.

9.1.2 Number of institutions where specialists training is available :
As above.

9.1.3 Facilities for non formal on job training :
In all Medical schools as part of the medical training of doctors in Australia.

9.2 Facilities for formal/non formal training of laboratory technicians
Within the Tb Reference Laboratories, in New South Wales, Queensland, South Australia, Western Australia and Victoria.

9.3 Facilities for formal/non formal training of treatment organisers.
Within the Chest Clinics in each State.

9.4 Facilities for formal/non formal training of other miscellaneous personnel required for NTP
Through meetings within the professional groups,(eg The Australian Society for Microbiology meetings, Australian Epidemiology Society meetings, Public Health Association meetings), Jounals of professional bodies (eg Medical Journal of Australia and Family Physician), newsletters (eg Australian Tb newsletter) and other group meetings.

10 RESEARCH

10.1 Brief description of research projects during the last year :
(1) Independent research through University unable to be documented.
(2) Research into the epidemiology of tuberculosis in Australia, 1985 - 1990, undertaken and completed by the Communicable Diseases Section of the Commonwealth Department of Health, Housing and

Community Services, Canberra, ACT.

10.2 Expenditure on research (separately by government/Tuberculosis Association)
Funding for a Masters student in Applied Epidemiology to analyse previously available data and to design a new surveillance system and to undergo training in the epidemiology of tuberculosis in Australia by the Commonwealth Department of Health, Housing and Community Services

10.3 Number of research schemes in hand :
(1) A cohort study of Tb in migrants for 1991 has recently been approved by the Tuberculosis Working Party of the National Health and Medical Research Council. This will be undertaken this year (1991).
(2) Individual projects cannot be identified at this stage.

10.3.1 Epidemiological research :
(1) Documentation of Tuberculosis in Australia 1985 - 1990, completed in 1991.
(2) Development of a surveillance system on Tb, using Epi Info.
(3) Development of a Laboratory surveillance system to monitor drug resistance patterns in Australia, completed in 1991.

10.3.2 Bacteriological research :
Extensive bacteriological research undertaken in Fairfield Hospital, Victoria on an ongoing basis. For individual research projects, contact Dr Brian Dwyer, at the hospital.

10.3.3 Clinical research
Individual research unable to be documented. Consultation with individual Tb program managers would be needed to ascertain this.

10.3.4 Operational research :
Unable to be documented.

11 FUTURE PLANS

11.1 Reasons for shortfall in performance under NTP
National coordination and surveillance has improved.

11.2 Plans to correct these shortfalls
Tb Working has been formed under the auspices of the National Health and Medical Research Council. The Communicable Diseases Network - Australia has enhanced the surveillance of the disease.

11.3 Any other innovative or developmental plan being contemplated :
An Elimination document is currently being formulated.

11.4 Any assistance being received from any source outside your country for developmental schemes (specify source and quantum of assistance received)
Nil

11.5 Do you need any assistance from the Eastern Region? (specify details and quantum of assistance required)
No.

QUESTIONNAIRE ON ANTI TUBERCULOSIS DRUG SUPPLY
National Experiences

Name : Dr David Cheah
Position : Epidemiology Registrar
Country : Australia
Date : 07-Sep-1992

DRUG FORECASTING

1 **Are drug needs estimated at the national level. If so, how are estimates of national anti TB drug needs made in your country: Are the estimates based on the number of TB patients treated in the previous year, previous semester or previous quarter? Or on the stock levels of regional or facility pharmacies? Or by another method please specify.**

Drug need are not estimated at the national level. Drug estimates are done at the state level by commercial suppliers who base their forward estimates on established usage, of the previous year. State governments then contract out to these commercial suppliers for the purchase of these drugs.

Have these forecasting methods been effective in preventing stock outs? (see also questions 19 and 20 on stock outs)

Short term fluctuations in usage are covered by reductions or increases in stock holdings at supplier, wholesaler and hospital level. These variations in stock holdings are not visible to the end user. In general terms, estimates based on previous year's demands have been effective in preventing stock outs.

2 **Do your drug estimates include a level of buffer (reserve) stocks at the national level? If yes, how is the level of the reserve stock determined?**
Are there programmed buffer stocks at the regional level?
At the district level?

Stock reserves are held locally (hospital) and regionally (wholesaler) and would vary from 2 to 6 weeks at normal usage. Stock reserves are determined from previous year usage.

3 **What are the recommended tuberculosis treatment regimens, and can you estimate what proportion of patients are placed on each regimen?**

Recommended regimes may vary in some cases. It is not possible to estimate the proportion of patients in each regimen, nationally. An example of a normal regime used in the Northern Territory is :

Daily treatment : (25% of patients)	Thrice weekly treatment: (75% of patients)
Isoniazid 300mg	Isoniazid 600mg
Rifampicin 600mg	Rifampicin 600mg
Pyrazinamide 2000mg	Pyrazinamide 2500mg
Ethambutol 1200 mg to 800mg	Ethambutol 1200mg
Vitamin B6 25 mg	

4 Are combined tablets used?
If so, which ones?
- Rifampicin/Isoniazid
_ Rifampicin/Isoniazid/Pyrazinamide
- Isoniazid/Thioacetazone
- Other (specify):

No

5 Are blister packs used?

No.

If so, packs include what quantity of which drugs?

If so, what proportion of patients treated receive blister packed drugs?

DRUG FINANCING

6 Is the tuberculosis programme responsible for the development of an annual budget for anti TB drugs?

Yes, at the state (local) level.

7 Who finances the procurement of anti TB drugs? The Ministry of Health, Ministry of Finance or an external source or other (specify)? If financing comes from an external source, please give the name of the bilateral agency, international organization or non governmental agency.

State/Territory Health Department.

8 Is the allocation of funds for anti TB drugs determined as part of the distribution of a general Ministry of Health drug budget? Or is it determined separately?

In general, the allocation of funds for anti TB drugs are determined as part of a block grant to health services.

9 How frequently are allocations made for anti TB drug supply needs? On an annual basis or more frequently?

Annually.

10 Is financing secure for 1992 drug supply needs? Is it sufficient?

Yes.

DRUG PROCUREMENT

11 Is drug procurement centralized at national level, or are regions/provinces or municipalities responsible for purchasing their own anti TB drugs?

State/Territory responsibility.

12 Is the national tuberculosis programme responsible for arranging the purchase of all the drugs required, or does it submit a request to a central medical stores, or essential drug programme? Or does a donor or nongovernmental agency arrange for drug procurement? Please describe the process.

Finance provided by State Government is used to purchase anti-TB drugs locally through normal commercial channels.

13 Are anti-TB drugs purchased through:
a) Tender on the international market (open or restricted?)
b) Local tender (open or restricted?)
c) Negotiated procurement with a supplier?
d) Direct procurement from a supplier?
If procurement is secured through a mixture of the above, please explain. Please also explained if the method varies by anti -TB drug needed.

Local tender(open) and direct procurement from a supplier are methods where anti Tb drugs are purchased. The Commonwealth Serum Laboratories supply pyrazinamide. Sigma(a private drug company) supplies isoniazid.

14 How much was spent (in US$ if possible) for all anti-TB drug supplies in 1990 (or, for the most recent year for which information is available. Please specify year)?

No national data available. Some state data are available, this is incomplete.

15 If possible, please provide the estimate cost (in US$ if possible) for each required drug for the most recent year for which information is available? Please specify price per unit and unit quantity.
Isoniazid
Pyrazinamide
Streptomycin
Ethambutol
Thioacetazone
Combinations (specify)
No national data available.

16 If possible, please provide a list of suppliers (and /or country of origin) from whom you have recently pruchased:

Rifampicin : Marion Merrel Dow Pty Ltd
Dandenong, Victoria.

Isoniazid : Sigma Pharmaceuticals Pty Ltd.
Clayton, Victoria.

Pyrazinamide : Commonwealth Serum Laboratory
Parkville, Victoria.

Ethambutol : Lederle Laboratories
Notting Hill, Victoria.

Streptomycin : No longer marketed in Australia.

Thioacetazone : Not marketed in Australia.

Combinations : (please specify) Not available.

DISTRIBUTION

17 Is the distribution of anti-TB drugs to regions and districts the direct responsibility of the national TB programme or another department or institution?

The distribution of anti-TB drugs is a State/Territory responsibility. There is no national programme. In general, distribution is through commercial parameters and is based on demand by the State/Territory Health Departments.

18 What is the method of deciding how many drugs go where in the country and when?

Based on local pharmacies requirement. (this is based on monthy requirement lists)

19 Did the national tuberculosis programme experience any drug stock-outs in 1991? For which drugs, and for how long? What was the cause of the stock-outs and how were they resolved?

No drug stock-outs were experienced in 1991.

20 How many districts reported drug stock-outs in 1990? What percentage of all districts was this?

Nil.

QUALITY

21 **Are there any mechanisms for anti-TB drug quality assurance, such as a national quality control laboratory? If so, please describe.**

The Drug and Therapeutic Goods Branch of the Commonwealth Department of Health, Housing and Community Services, in Woden, Canberra, monitors standards of drugs in Australia.

PRODUCTION

21 **If anti-TB drugs are produced locally, please provide name of, and any information you might have on, the local producers (e.g., any anti-TB products produced, production capacity, do they produce raw produuct or only handle drug formulation, etc)**

Most suppliers of anti-TB drugs in Australia, uses international sources for raw materials.

Capreomycin - final product imported (lilly - US)

Ethambutol - overseas raw materials, local manufacturer (Lederle).

Isoniazid - overseas raw materials, local manufacturer (Sigma).

Prothionamide - final product imported.

Pyrazinamide - final product imported.

Rifampicin - overseas raw material, local manufacturer (Merrel Dow)

COMMONWEALTH OF AUSTRALIA

TUBERCULOSIS DATA - 1990

Prepared by :

COMMUNICABLE DISEASE SECTION

COMMUNICABLE DISEASES AND INTERNATIONAL HEALTH BRANCH

DEPARTMENT OF HEALTH, HOUSING AND COMMUNITY SERVICES

TUBERCULOSIS REPORT 1990

(A) NOTIFICATIONS : CASES

1	Table 1 Figure 1	Tuberculosis notifications (new cases) Rate per 100,000
2	Table 2	BCG - Bovis notifications from states
3	Table 3 Figure 3	Atypical Mycobacteria notifications Rate per 100,000
4	Table 4 Figure 4	Notifications of new cases + relapses Rate per 100,000
5	Table 5 Figure 5	Notification of Tuberculosis Deaths Rate per 100,000

(B) NEW CASES OF TUBERCULOSIS :

6	Table 6 Figure 6	(A) Location of Disease (all sites) & Sex (B) Extrapulmonary sites and Sex
7	Table 7 Figure 7	(A) By Agegroup and Sex of Patients (B) Agegroup Specific Rates and Sex
8	Table 8 Figure 8	Pulmonary Sites : - By Agegroup and Sex of Patients
9	Table 9 Figure 9	Extrapulmonary Sites : - By Agegroup and Sex of Patients
10	Table 10 Figure 10	(A) By Birthplace : - (Australian born vs Foreign Born) (B) By Specific Country of birth

(C) RELAPSES CASES OF TUBERCULOSIS

11	Table 11 Figure 11	Location of Disease (all sites) & Sex
12	Table 12 Figure 12	By Agegroup and Sex of Patients

(D) ATYPICAL MYCOBACTERIA NOTIFICATIONS

13	Table 13 Figure 13	By Isolates
14	Table 14 Figure 14	Location of Disease (all sites) & Sex
15	Table 15 Figure 15	(A) By Agegroup and Sex of Patients (B) Agegroup Specific Rates and Sex

* Rate per 100,000 (mid year population supplied by the ABS)

CASE DEFINITIONS

1 TUBERCULOSIS (NEW CASES)

- A case which has been confirmed by the identification of Mycobacterium tuberculosis culture or by microscopy.
- A case of TB which has been diagnosed to be active clinically and which has been accepted, as such, by the State or Territory Director of TB.
- Infectious agents are usually from the **Mycobacterium Tuberculosis Complex** - M. TB, M. africanum and M. bovis (not including BCG - Bovis)
- BCG - Bovis is reported separately.

2 RELAPSE (REACTIVATION)

- A case of active tuberculosis diagnosed again (bacteriologically, radiologically or clinically) following previous full treatment, (as deemed appropriate by the Director of TB) and considered to be inactive or quiescent.

3 ATYPICAL MYCOBACTERIAL INFECTION

- An active case of "atypical" mycobacterial disease is one when there are clinical features consistent with one or more of the following :

. presence of compatible disease process which is clinically, radiologically and/or pathologically not due to other causes.
. consistent repeated recovery of the same organism from the same site in moderate to abundant amounts.
. recovery of atypical mycobacterium from sites which are normally sterile.

3 INCIDENCE RATE

-The number of new cases of tuberculosis diagnosed or reported during a defined period of time,(usually one year) divided by the number of persons in a stated population.

4 POPULATION

- The number of persons living in an area at mid year. This information is supplied by the Australian Bureau of Statistics.

5 TUBERCULOSIS DEATHS

- Deaths from tuberculosis, (all forms including relapses) during the year, including deaths due to, and incidental to the disease.

6 LOCATION OF DISEASE

- The predominant site of the disease based on the criteria set by the American Thoracic Society. These sites may be multiple in some individuals and may include presumed and confirmed cases.

7 COUNTRY OF BIRTH

- The countries selected are based on those countries reporting more than ten cases a year. (based in the 86/87 data) The groupings are based on the Australian Bureau of Statistics and as such, will have denominators for comparison purposes.

NOTIFICATIONS : CASES AND DEATHS

TUBERCULOSIS IN AUSTRALIA 1990
TABLE 1 - TUBERCULOSIS NOTIFICATIONS (NEW CASES)

STATE	POPULATION	NO CASE	RATE*
NSW	5827400	346	5.94
VIC	4380000	255	5.82
QLD	2906800	93	3.2
SA	1439200	85	5.91
WA	1633900	118	7.22
TAS	456700	11	2.41
NT	157300	60	38.14
ACT	285000	11	3.86
AUSTRALIA	17086300	979	5.73

*rate per 100,000 based on the mid year population.

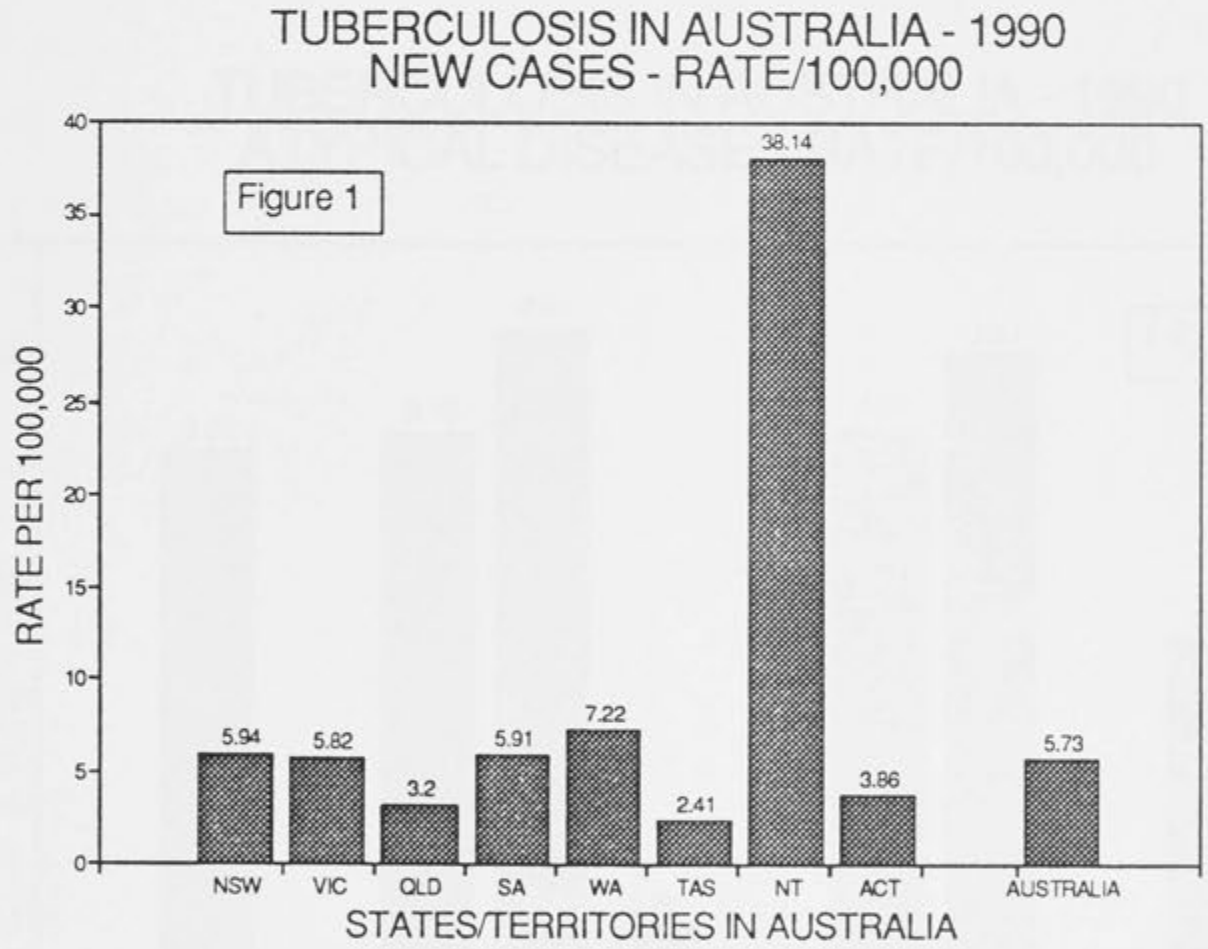


TABLE 2 - BCG - BOVIS NOTIFICATIONS FROM STATES*

STATES	NO REPORTED
SA	3

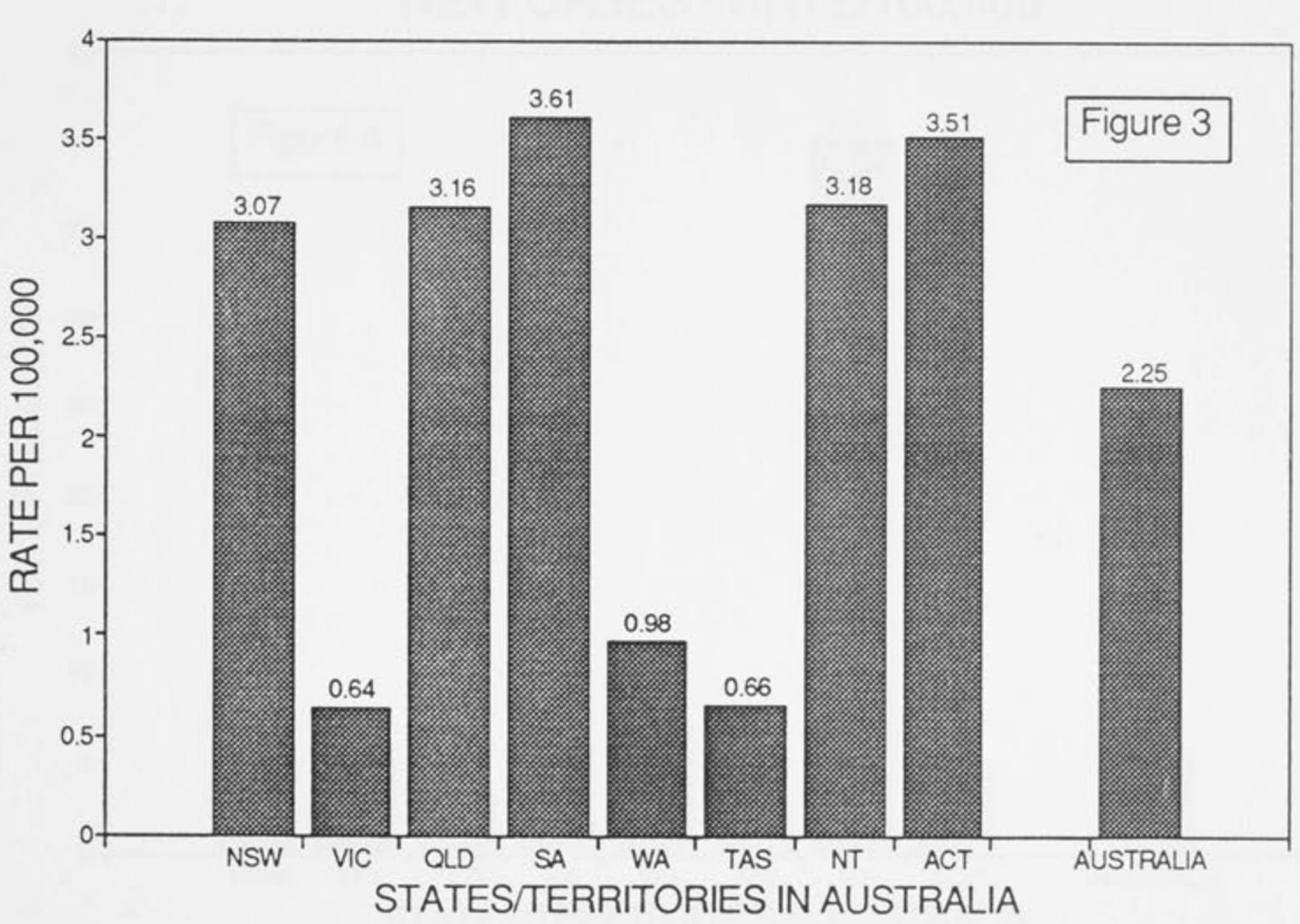
*BCG-BOVIS is not compulsorily reported in all states.

TUBERCULOSIS IN AUSTRALIA 1990
TABLE 3 - NOTIFICATION OF ATYPICAL DISEASE

STATE	POPULATION	NO CASES	RATE*
NSW	5827400	179	3.07
VIC	4380000	28	0.64
QLD	2906800	92	3.16
SA	1439200	52	3.61
WA	1633900	16	0.98
TAS	456700	3	0.66
NT	157300	5	3.18
ACT	285000	10	3.51
AUSTRALIA	17086300	385	2.25

*rate per 100,000 based on the mid year population.

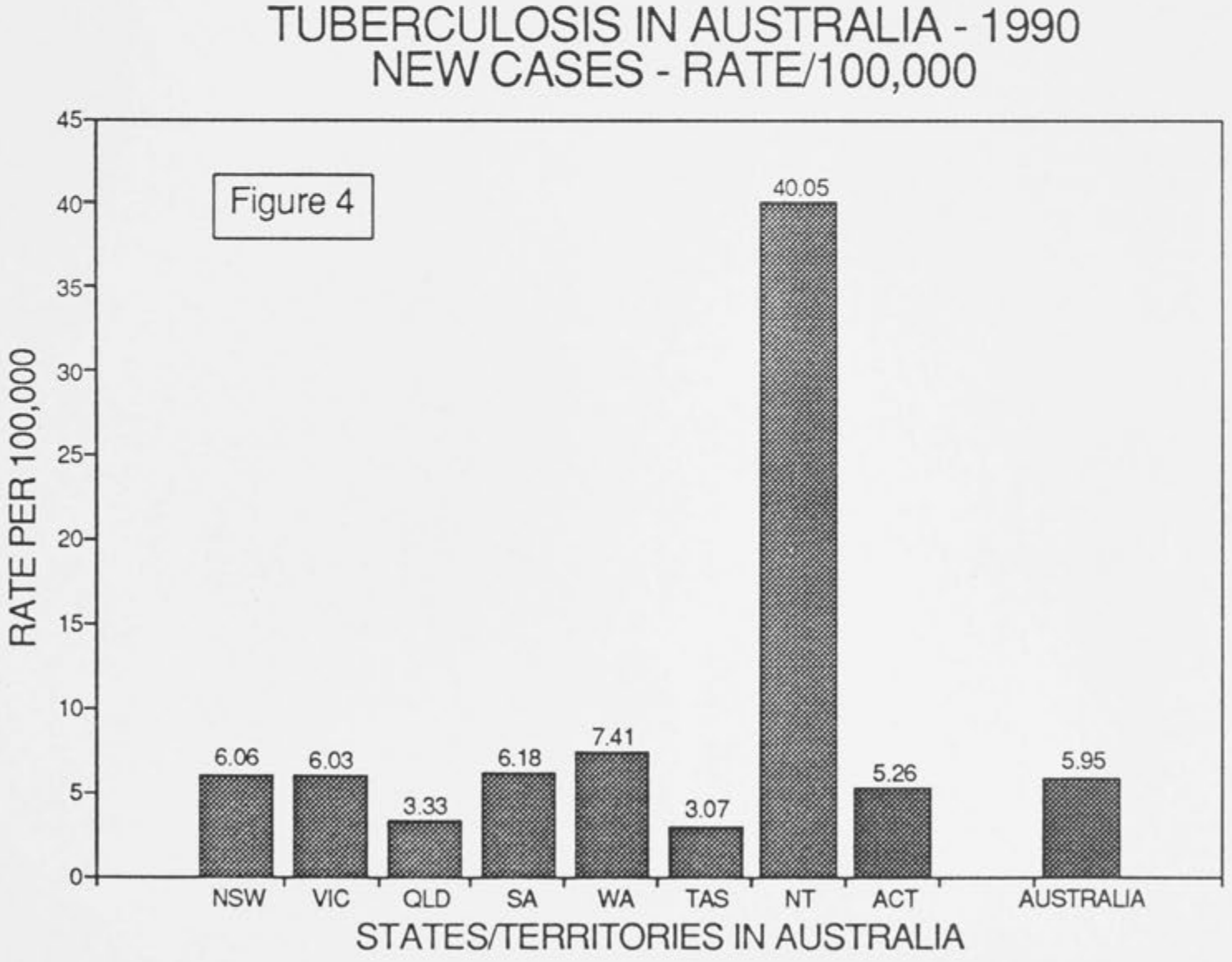
TUBERCULOSIS IN AUSTRALIA - 1990
ATYPICAL DISEASE - RATE/100,000



TUBERCULOSIS IN AUSTRALIA 1990
TABLE 4 - NOTIFICATIONS (NEW CASES + RELAPSES)

STATE	POPULATION	NO CASES	RATE*
NSW	5827400	353	6.06
VIC	4380000	264	6.03
QLD	2906800	97	3.33
SA	1439200	89	6.18
WA	1633900	121	7.41
TAS	456700	14	3.07
NT	157300	63	40.05
ACT	285000	15	5.26
AUSTRALIA	17086300	1016	5.95

*rate per 100,000 based on the mid year population.

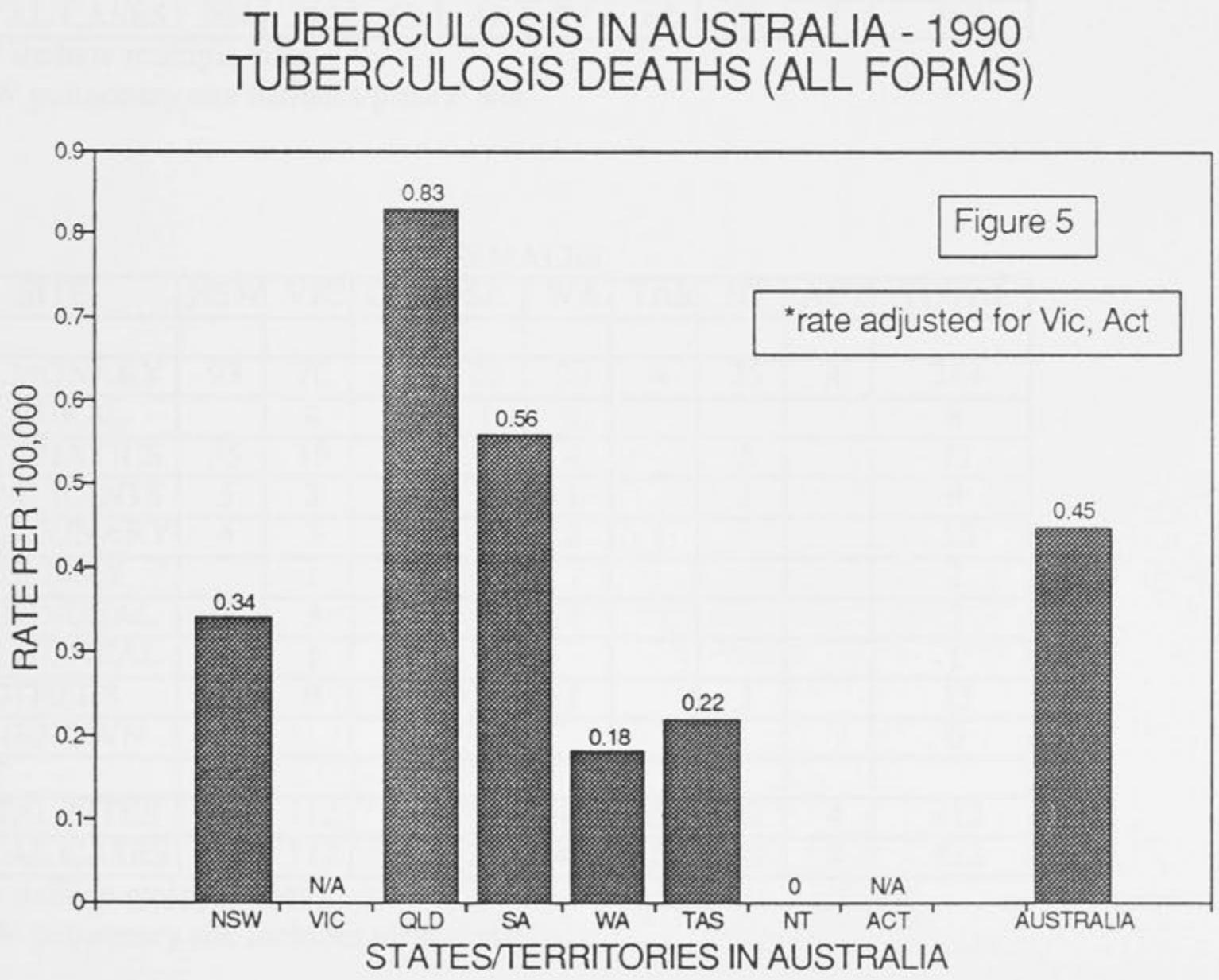


NEW CASES OF TUBERCULOSIS

TUBERCULOSIS IN AUSTRALIA 1990
TABLE 5 - TUBERCULOSIS DEATHS (ALL FORMS)

STATE	POPULATION	NO CASES	RATE*
NSW	5827400	20	0.34
VIC	4380000	N/A	N/A
QLD	2906800	24	0.83
SA	1439200	8	0.56
WA	1633900	3	0.18
TAS	456700	1	0.22
NT	157300	0	0
ACT	285000	N/A	N/A
AUSTRALIA	12421300	56	0.45

*rate per 100,000 based on the mid year population.



TUBERCULOSIS IN AUSTRALIA 1990
TABLE 6 - LOCATION OF DISEASE (ALL SITES) AND SEX

MALES

SITE	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	TOTAL
PULMONARY	170	104	43	46	67	5	22	4	461
PLEURAL		10	2		4	1	1	1	19
LYMPHATICS	16	12	2		4		4	1	39
BONE/JOINTS	6	2	2			1			11
GEN/URINARY	7	5	3	1	1			1	18
MILIARY		3		1					4
MENINGEAL	1								1
PERITONEAL									0
OTHERS	4	7	1	1	1		1		15
UNKNOWN									0
TOTAL SITES	204	143	53	49	77	7	28	7	568
TOTAL CASES	204	143	53	49	77	6*	28	7	567

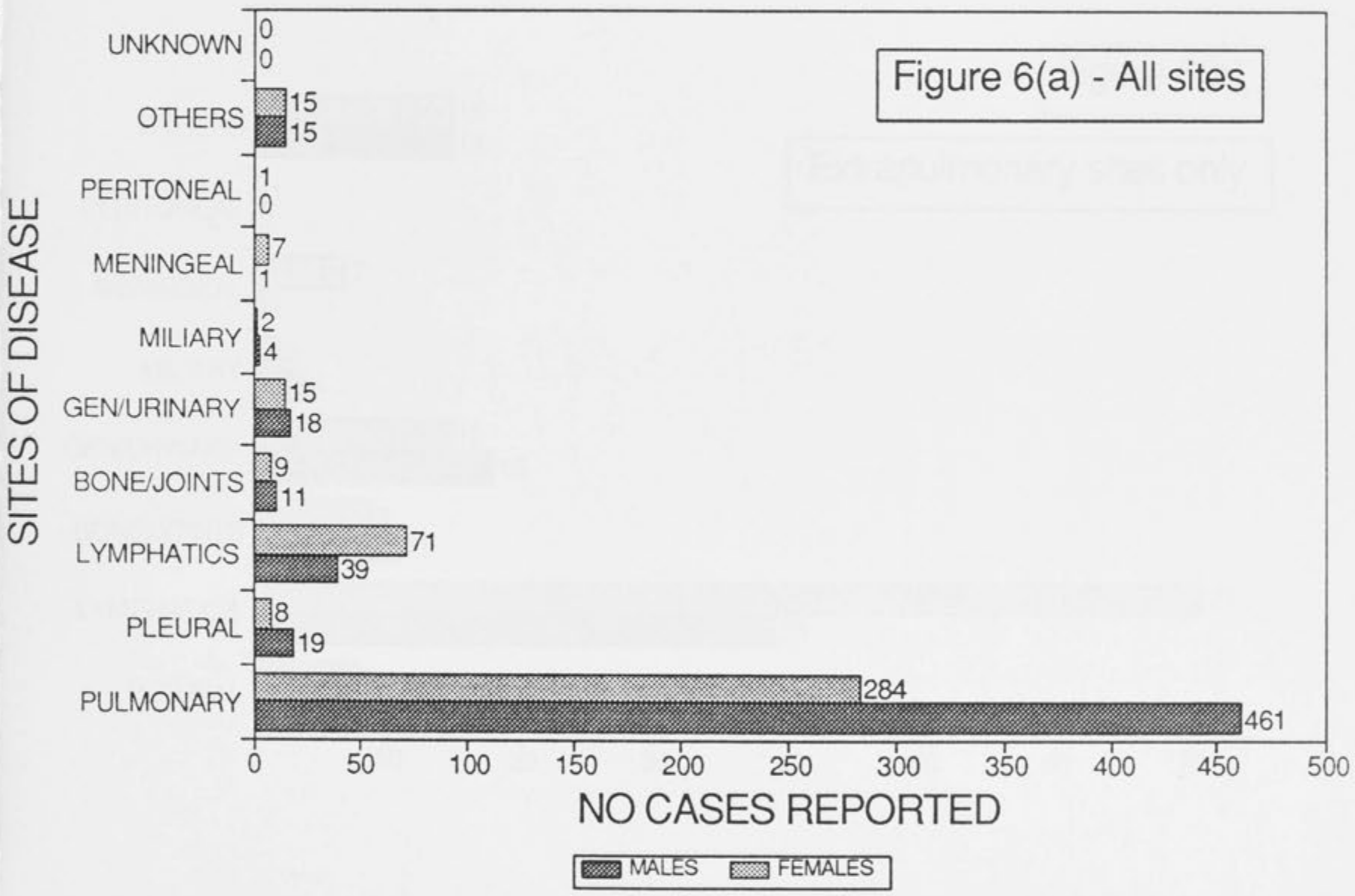
*may include multiple sites
*NSW pulmonary site includes pleural site

FEMALES

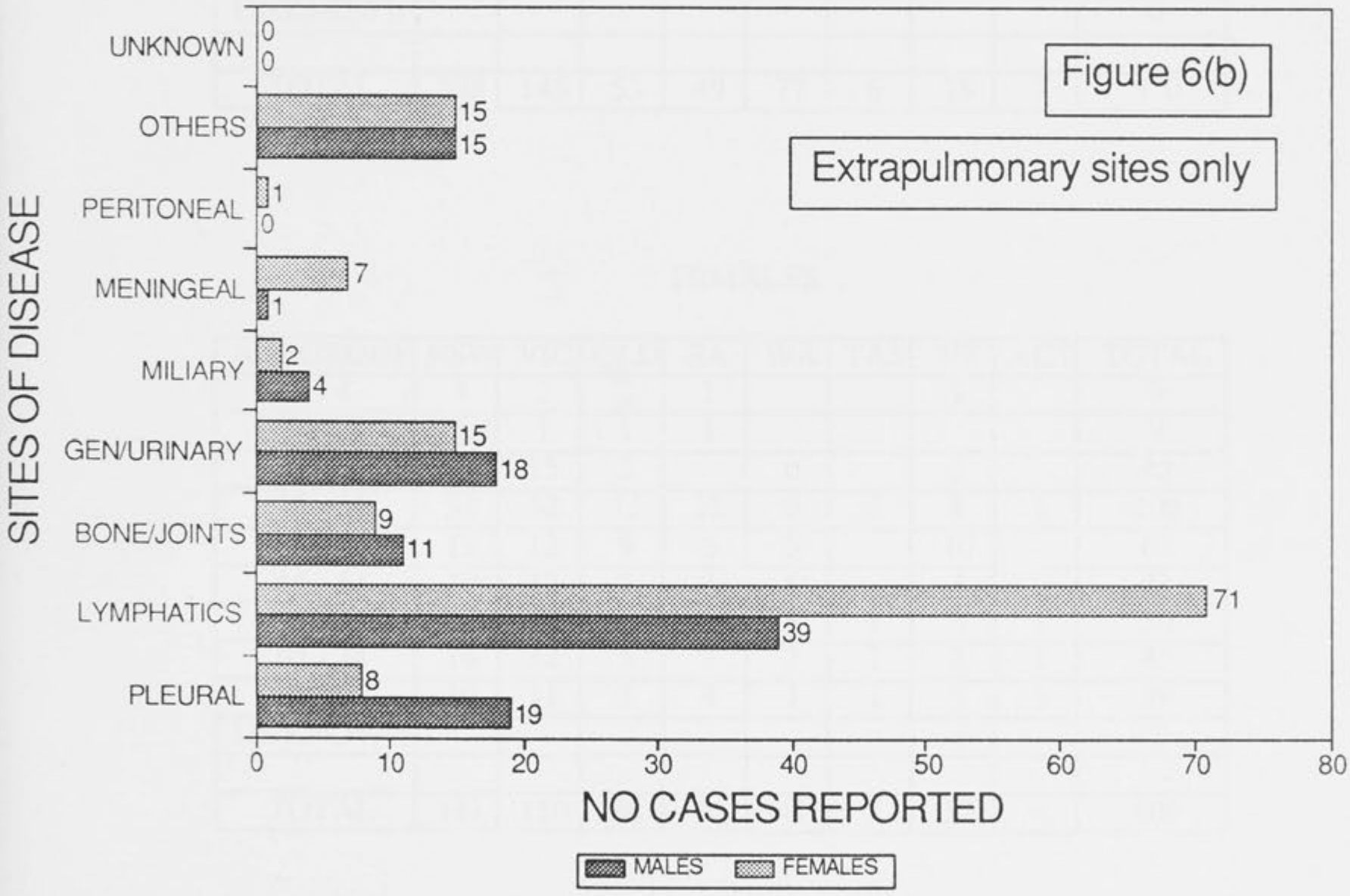
SITE	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	TOTAL
PULMONARY	93	70	32	26	30	4	25	4	284
PLEURAL		4	1	1	2				8
LYMPHATICS	35	19	4	4	4		5		71
BONE/JOINTS	5	2			1		1		9
GEN/URINARY	4	3	3	2	2	1			15
MILIARY		1		1					2
MENINGEAL	3	3			1				7
PERITONEAL		1							1
OTHERS	2	9		2	1		1		15
UNKNOWN									0
TOTAL SITES	142	112	40	36	41	5	32	4	412
TOTAL CASES	142	112	40	36	41	5	32	4	412

*may include multiple sites
*NSW pulmonary site includes pleural site

TUBERCULOSIS IN AUSTRALIA 1990
LOCATION OF DISEASE AND SEX OF PATIENTS



TUBERCULOSIS IN AUSTRALIA 1990
EXTRAPULMONARY SITES AND SEX



TUBERCULOSIS IN AUSTRALIA 1990
TABLE 7 (A) - BY AGEGROUP AND SEX

MALES

AGEGROUP	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	TOTAL
0 - 4	4	2	4		2		1	1	14
5 - 14	5	2	1				3		11
15 - 24	24	16	3	4	7		3		57
25 - 34	33	28	4	5	20	1	5	3	99
35 - 44	35	25	10	5	9		6		90
45 - 54	24	13	3	4	7	1	6		58
55 - 64	20	20	14	10	19	2	3	1	89
65 - 74	33	20	5	15	9	2		2	86
>75	27	19	9	6	4		1		66
UNKNOWN									0
TOTAL	205	145	53	49	77	6	28	7	570

FEMALES

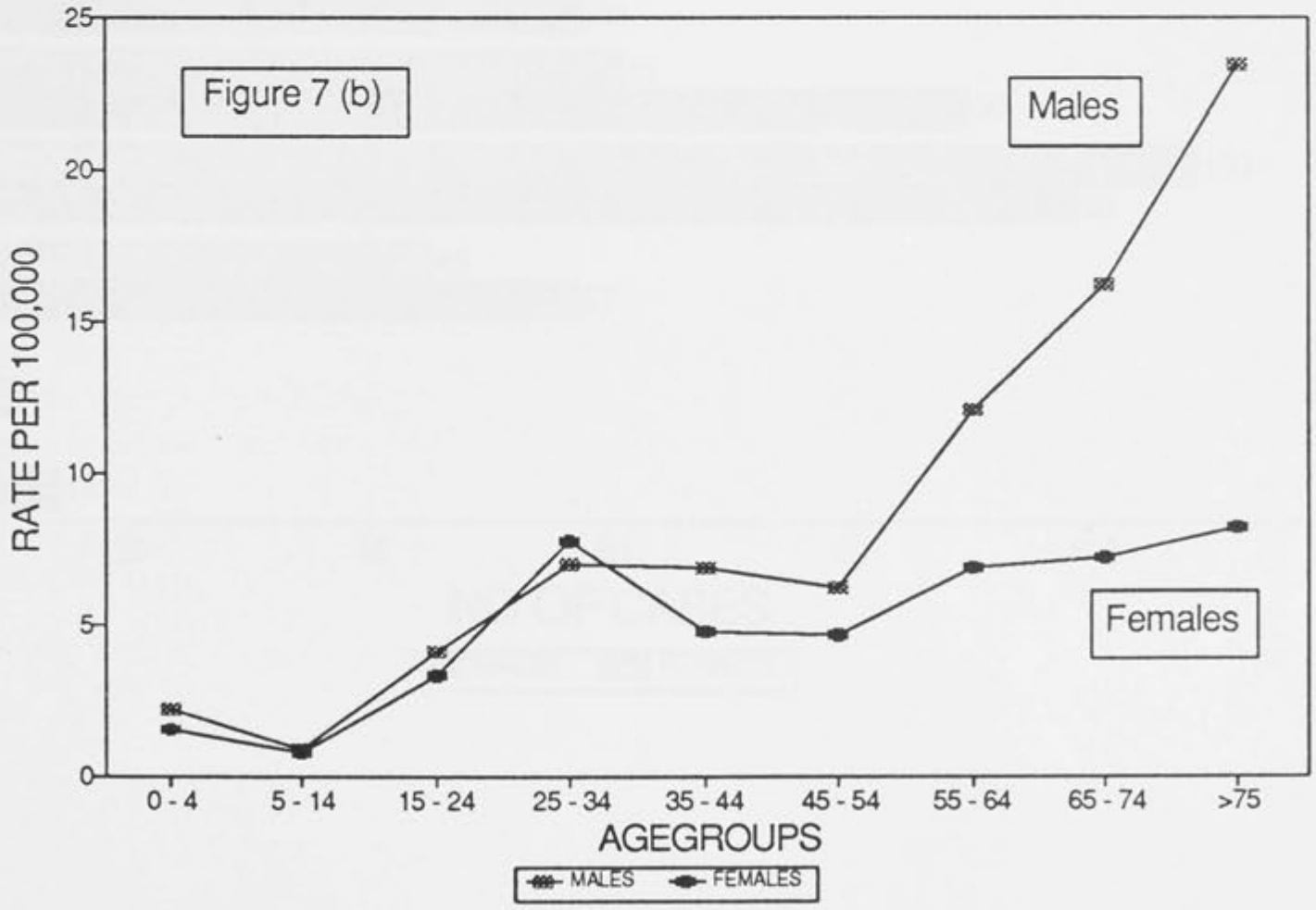
AGEGROUP	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	TOTAL
0 - 4	3	2	2	1			1		9
5 - 14	6	1	1	1					9
15 - 24	19	15	2		6		3		45
25 - 34	33	32	12	12	9	2	8	1	109
35 - 44	19	12	9	6	5		10		61
45 - 54	10	12	7	3	5		4		41
55 - 64	16	13	1	7	8	1	3	1	50
65 - 74	16	12	5	2	7	1	1	1	45
>75	19	11	1	4	1	1	1	1	39
UNKNOWN							1		1
TOTAL	141	110	40	36	41	5	32	4	409

TUBERCULOSIS IN AUSTRALIA 1990
TABLE 7 (B) - AGEGROUP SPECIFIC RATES AND SEX

AGEGROUP	MALES	POPULATION	RATE	FEMALE	POPULATION	RATE
0 - 4	14	641745	2.18	9	611190	1.47
5 - 14	11	1275775	0.86	9	1212989	0.74
15 - 24	57	1413684	4.03	45	1353628	3.32
25 - 34	99	1423947	6.95	109	1396319	7.81
35 - 44	90	1304337	6.9	61	1279282	4.77
45 - 54	58	927338	6.25	41	880861	4.65
55 - 64	89	732290	12.15	50	725232	6.89
65 - 74	86	530698	16.21	45	620756	7.25
>75	66	281389	23.46	39	474737	8.21
UNKNOWN				1		
TOTAL	570	8531203	6.68	409	8554994	4.78

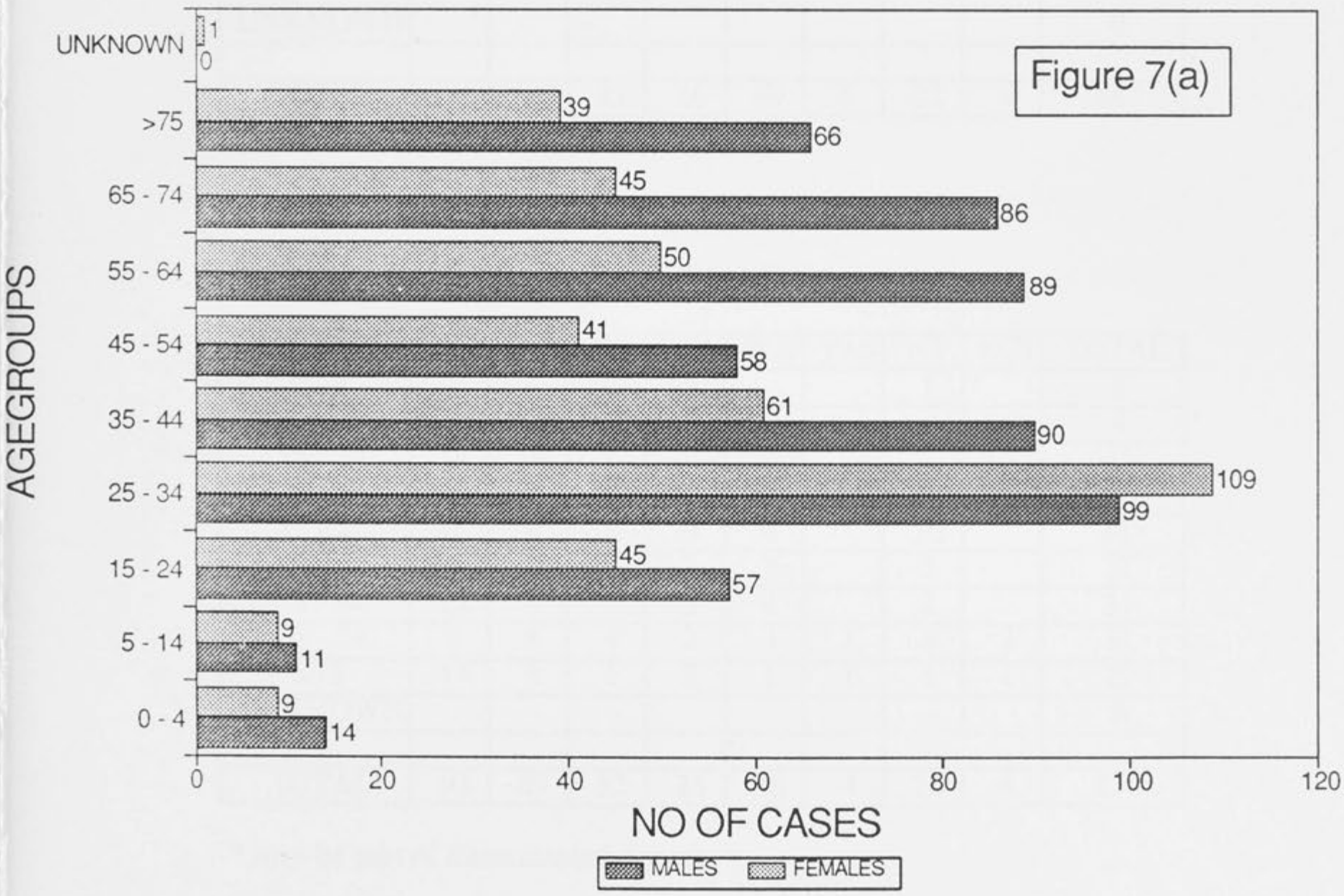
*Rate per 100,000

TUBERCULOSIS IN AUSTRALIA 1990
AGEGROUP SPECIFIC RATES



TUBERCULOSIS IN AUSTRALIA 1990
AGEGROUP AND SEX OF PATIENTS

Figure 7(a)



TUBERCULOSIS IN AUSTRALIA 1990
TABLE 8 - PULMONARY SITES BY AGEGROUP AND SEX*

MALES

AGEGROUP	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	TOTAL
0 - 4	3	1	2		2		1		9
5 - 14	4	1	1				1		7
15 - 24	21	15	3	4	5		1		49
25 - 34	25	18	3	5	18	1	5	2	74
35 - 44	27	18	8	5	8		5		71
45 - 54	21	12	3	4	6		5		51
55 - 64	16	13	12	9	18	2	3	1	74
65 - 74	29	16	4	14	8	2		1	74
>75	24	14	7	5	4		1		55
UNKNOWN									0
TOTAL	170	108	43	46	69	5	22	4	467

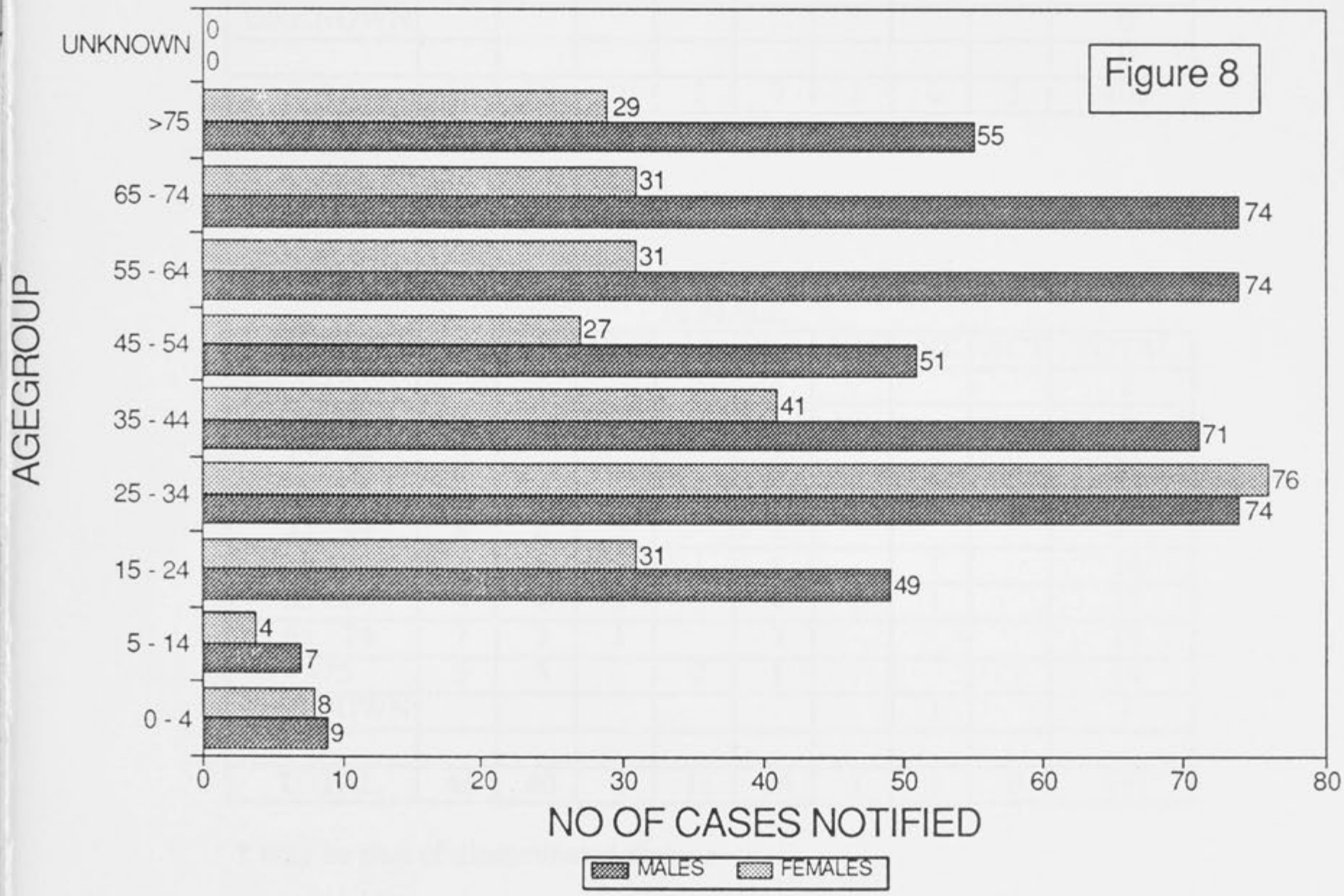
FEMALES

AGEGROUP	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	TOTAL
0 - 4	3	1	2	1			1		8
5 - 14	3	1							4
15 - 24	14	10	2		4		1		31
25 - 34	22	21	11	7	6	2	6	1	76
35 - 44	11	4	6	6	4		10		41
45 - 54	5	8	6	2	3		3		27
55 - 64	12	8		5	4		2		31
65 - 74	9	8	4	2	4	1	1	2	31
>75	14	8	1	2	1	1	1	1	29
UNKNOWN									0
TOTAL	93	69	32	25	26	4	25	4	278

* may be part of disseminated disease

TUBERCULOSIS IN AUSTRALIA 1990
PULMONARY SITE-AGEGROUP AND SEX

Figure 8



TUBERCULOSIS IN AUSTRALIA 1990
TABLE 9 - EXTRAPULMONARY SITES BY AGEGROUP AND SEX*

MALE

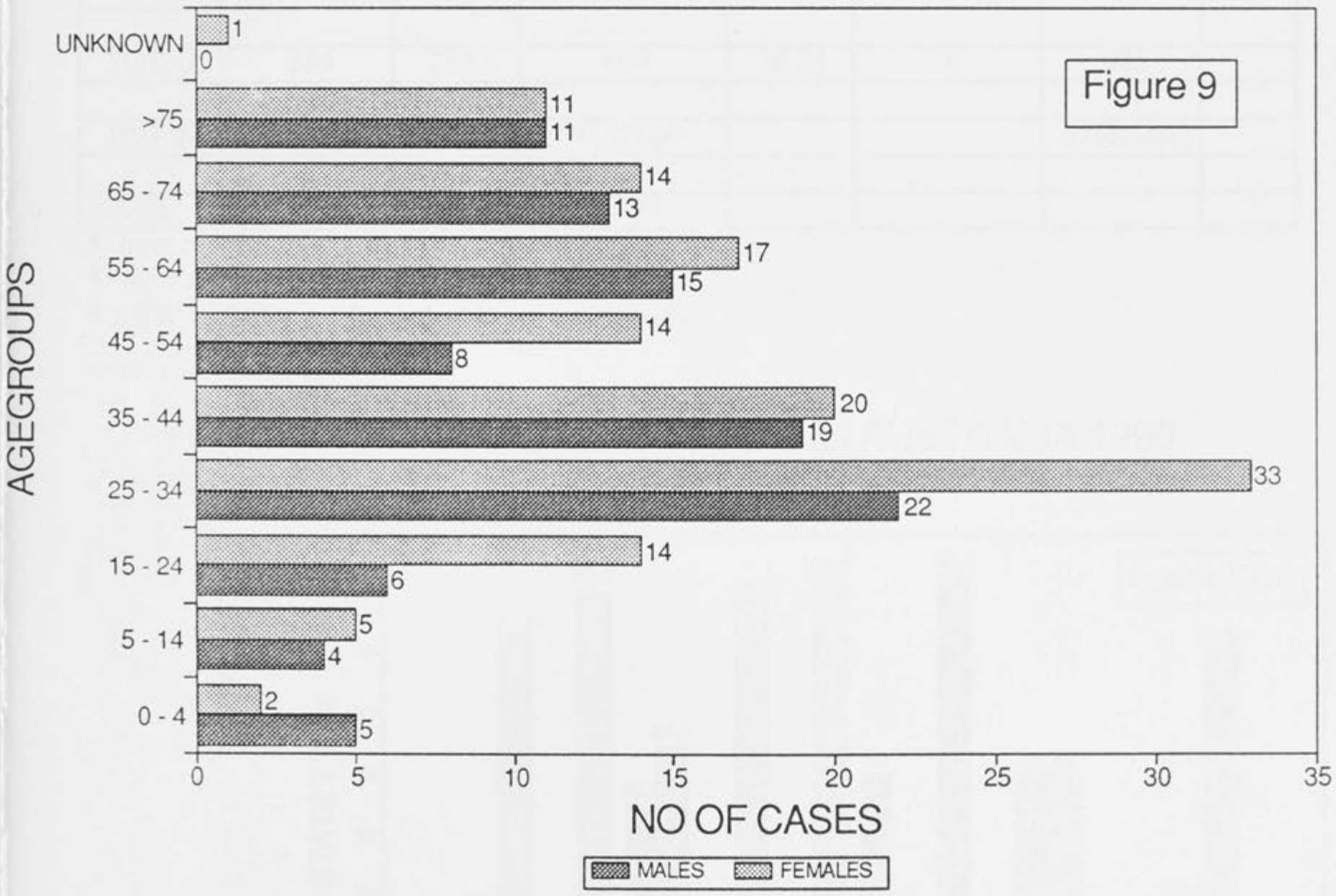
AGEGROUP	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	TOTAL
0 - 4	1	1	2					1	5
5 - 14	1	1					2		4
15 - 24	3	1					2		6
25 - 34	8	10	1		2			1	22
35 - 44	8	7	2		1		1		19
45 - 54	3	2			1	1	1		8
55 - 64	4	6	2	1	2				15
65 - 74	4	5	1	1	1			1	13
>75	3	5	2	1					11
UNKNOWN									0
									0
TOTAL	35	38	10	3	7	1	6	3	103

FEMALE

AGEGROUP	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	TOTAL
0 - 4		1			1				2
5 - 14	3		1	1					5
15 - 24	5	5			2		2		14
25 - 34	11	11	1	5	3		2		33
35 - 44	8	8	3		1				20
45 - 54	5	5	1	1	1		1		14
55 - 64	4	4	1	2	4	1	1		17
65 - 74	7	3	1		3				14
>75	5	3		2	1				11
UNKNOWN							1		1
TOTAL	48	40	8	11	16	1	7	0	131

* may be part of disseminated disease

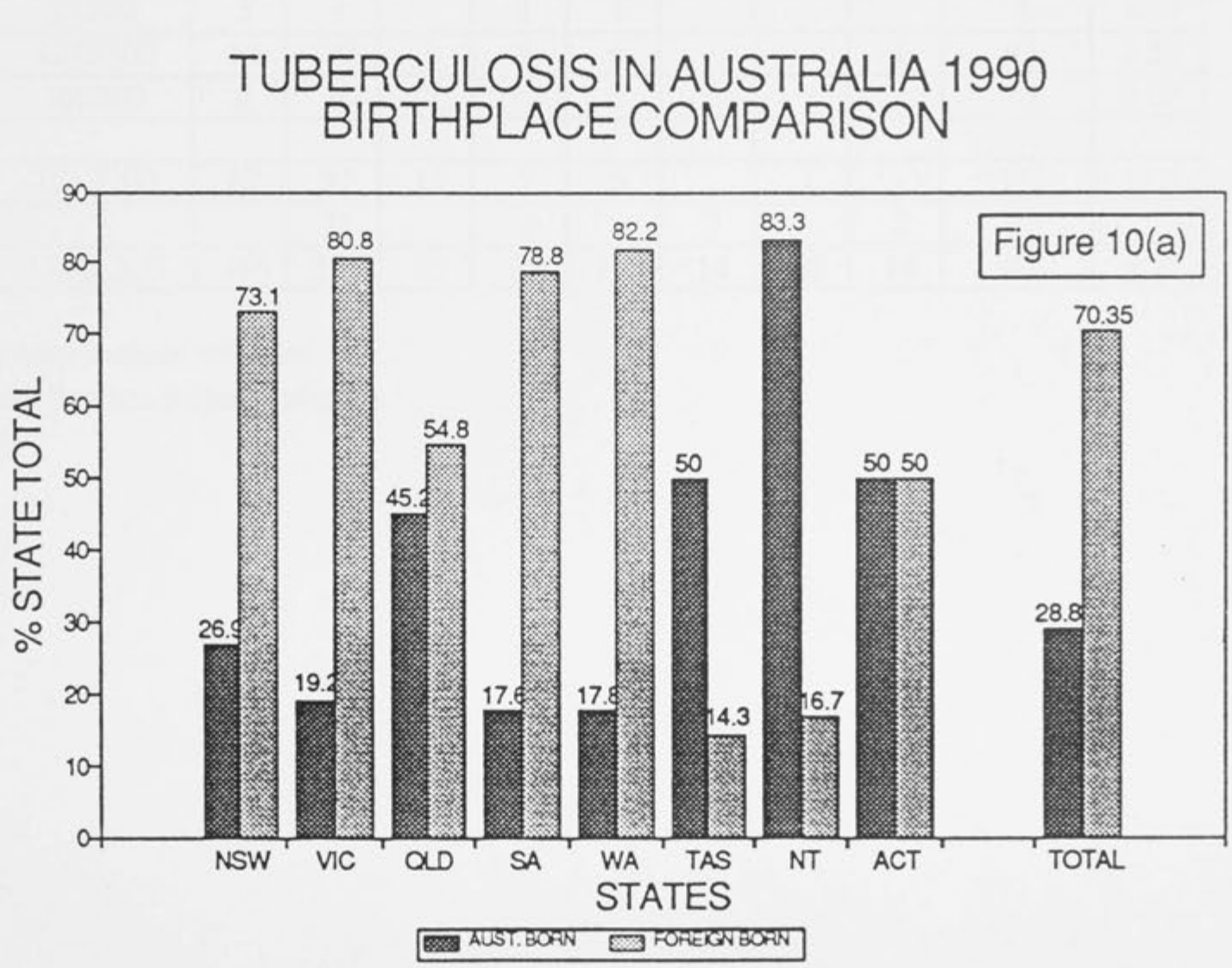
TUBERCULOSIS IN AUSTRALIA 1990
EXTRAPULMONARY SITES-AGEGROUPS AND SEX



TUBERCULOSIS IN AUSTRALIA 1990
TABLE 10 (A) - BIRTH PLACE COMPARISON
(Australian born vs Foreign born) - Rate per 100,000

STATE	AUS BORN	% TOT	FOR'N BORN	% TOT	UNKNOWN	TOTAL	NOTE
NSW	93	26.9	253	73.1	-	346	*
VIC	49	19.2	206	80.8	-	255	*
QLD	42	45.2	51	54.8	-	93	*
SA	15	17.6	67	78.8	3	85	*
WA	21	17.8	97	82.2	-	118	*
TAS	7	50	2	14.3	5	14	**
NT	50	83.3	10	16.7	-	60	*
ACT	7	50	7	50	-	14	**
TOTAL	284	28.83	693	70.35	8	985	
POP'N	13234700		3851600			17086300	
RATE	2.15		17.99				

* new cases only
** new cases+relapses
* NSW includes confirmed and presumed cases



TUBERCULOSIS IN AUSTRALIA 1990

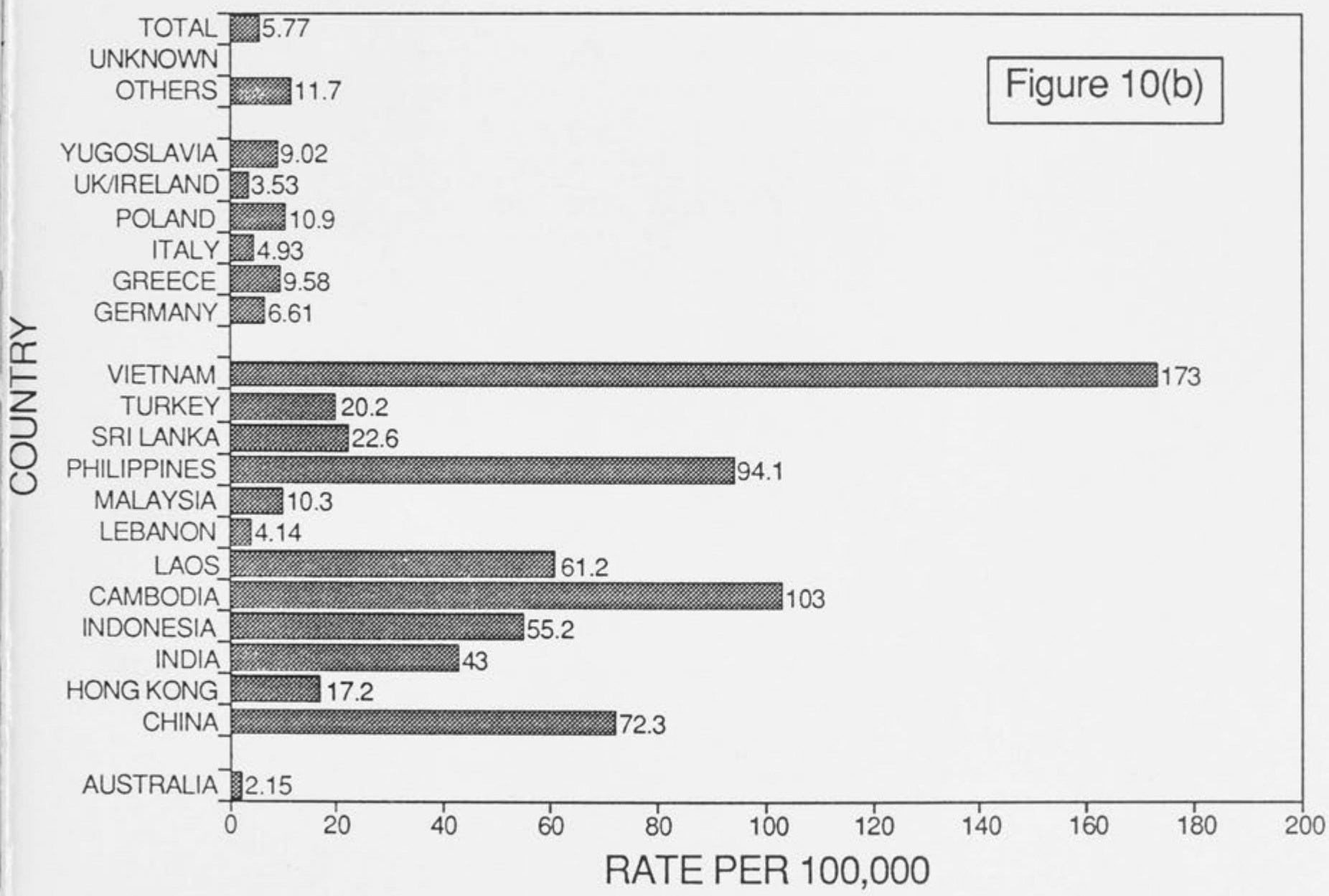
TABLE 10 (B) - RATE BY COUNTRY OF BIRTH

COUNTRY	POP'N	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	TOTAL	RATE
AUSTRALIA	13234700	93	49	42	15	21	7	50	7	284	2.15
CHINA	65000	22	15	4	2	2			2	47	72.3
HONG KONG	58200	7	1	1		1				10	17.2
INDIA	60400	9	13		2	1		1		26	43
INDONESIA	32600	12	3	2		1				18	55.2
CAMBODIA	18500	4	10		4	1				19	103
LAOS	9800	5	1							6	61.2
LEBANON	72500	2	1							3	4.14
MALAYSIA	77600	1	2		1	4				8	10.3
PHILIPPINES	68000	30	8	12	6	2		6		64	94.1
SRI LANKA	35400	2	5			1				8	22.6
TURKEY	29700	0	6							6	20.2
VIETNAM	119700	35	53	7	38	70		2	2	207	173
GERMANY	121000	4	1	2	1					8	6.61
GREECE	146100	6	6		1	1				14	9.58
ITALY	263800	3	8	1	1					13	4.93
POLAND	73700	3	3		1	1				8	10.9
UK/IRELAND	1219300	18	10	5	3	6			1	43	3.53
YUGOSLAVIA	166300	8	4	2		1				15	9.02
OTHERS	1213900	82	31	15	7	6		1		142	11.7
UNKNOWN			25		3		7		2	37	
TOTAL	17086200	346	255	93	85	119	14	60	14	986	5.77

* WA notification may include relapses
* ACT and TAS notification include relapses
* Rate per 100,000

TUBERCULOSIS IN AUSTRALIA 1990
RATE BY COUNTRY OF BIRTH

Figure 10(b)



RELAPSE CASES OF TUBERCULOSIS

TUBERCULOSIS IN AUSTRALIA 1990
TABLE 11 - NOTIFICATIONS OF RELAPSES
LOCATION OF DISEASE (ALL SITES) AND SEX

MALES

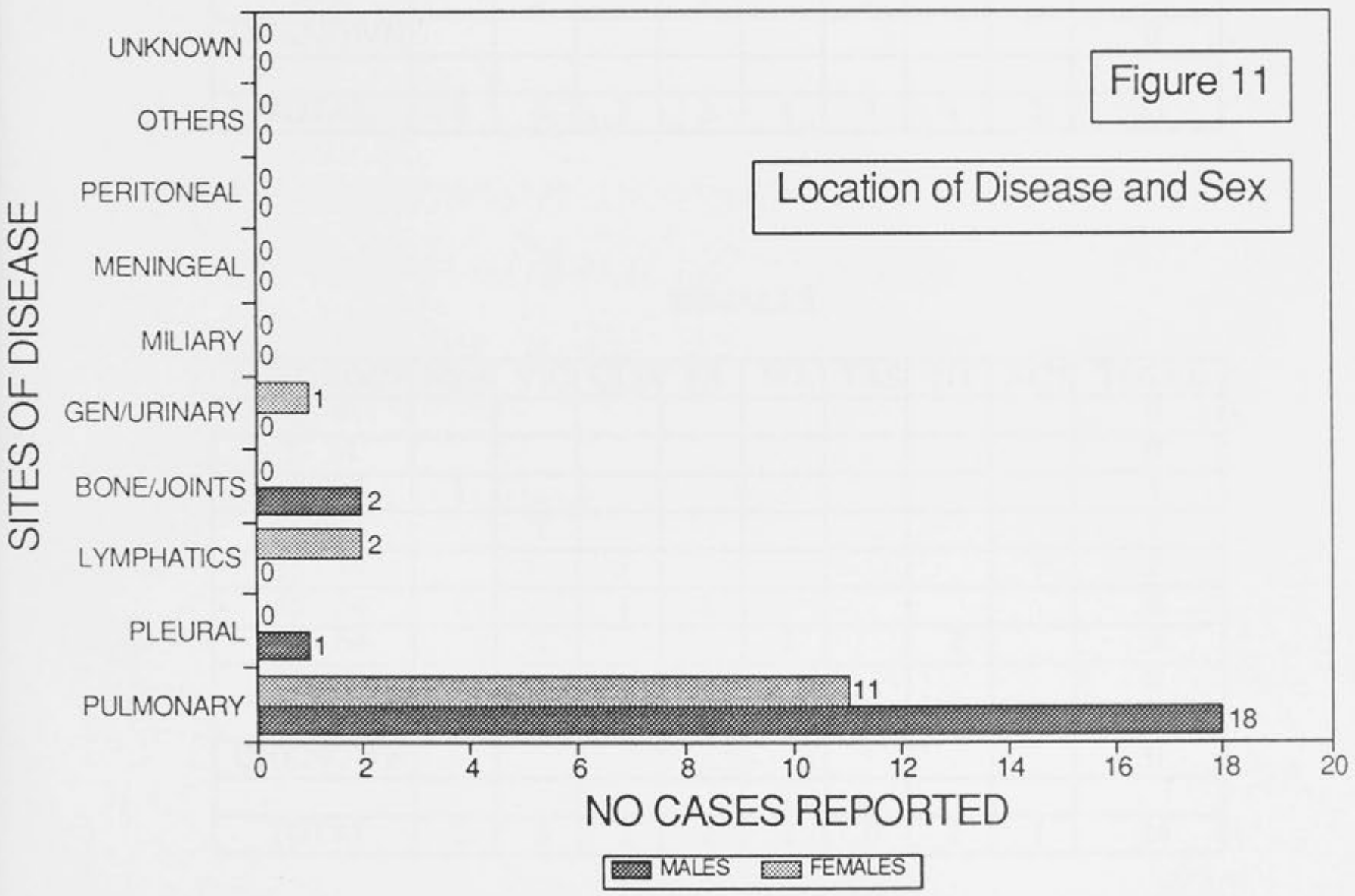
SITE	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	TOTAL
PULMONARY	3	6	2	2		3	1	1	18
PLEURAL					1				1
LYMPHATICS									0
BONE/JOINTS	1							1	2
GEN/URINARY									0
MILIARY									0
MENINGEAL									0
PERITONEAL									0
OTHERS									0
UNKNOWN									0
									0
TOTAL SITES	4	6	2	2	1	3	1	2	21
TOTAL CASES	4	6	2	2	1	3	1	2	21

FEMALES

SITE	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	TOTAL
PULMONARY	1	3	2	1	2		2		11
PLEURAL									0
LYMPHATICS	1							1	2
BONE/JOINTS									0
GEN/URINARY				1					1
MILIARY									0
MENINGEAL									0
PERITONEAL									0
OTHERS									0
UNKNOWN									0
									0
TOTAL SITES	2	3	2	2	2	0	2	1	14
TOTAL CASES	2	3	2	2	2	0	2	1	14

*NSW pulmonary site includes pleura

TUBERCULOSIS IN AUSTRALIA 1990
NOTIFICATION OF RELAPSES



TUBERCULOSIS IN AUSTRALIA 1990
TABLE 12 - NOTIFICATION OF RELAPSES
BY AGEGROUP AND SEX

MALES

AGEGROUP	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	TOTAL
0 - 4									0
5 - 14									0
15 - 24							1		1
25 - 34		2	1						3
35 - 44									0
45 - 54	3					1		1	5
55 - 64		1		1	1			1	4
65 - 74	1	1	1						3
>75		2		1		2			5
UNKNOWN									0
TOTAL	4	6	2	2	1	3	1	2	21

FEMALES

AGEGROUP	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	TOTAL
0 - 4									0
5 - 14									0
15 - 24	1								1
25 - 34		1							1
35 - 44			1					1	2
45 - 54	1		1	1					3
55 - 64		1			2		2		5
65 - 74									0
>75		1		1					2
UNKNOWN									0
TOTAL	2	3	2	2	2	0	2	1	14

TUBERCULOSIS IN AUSTRALIA 1990
NOTIFICATION OF RELAPSES

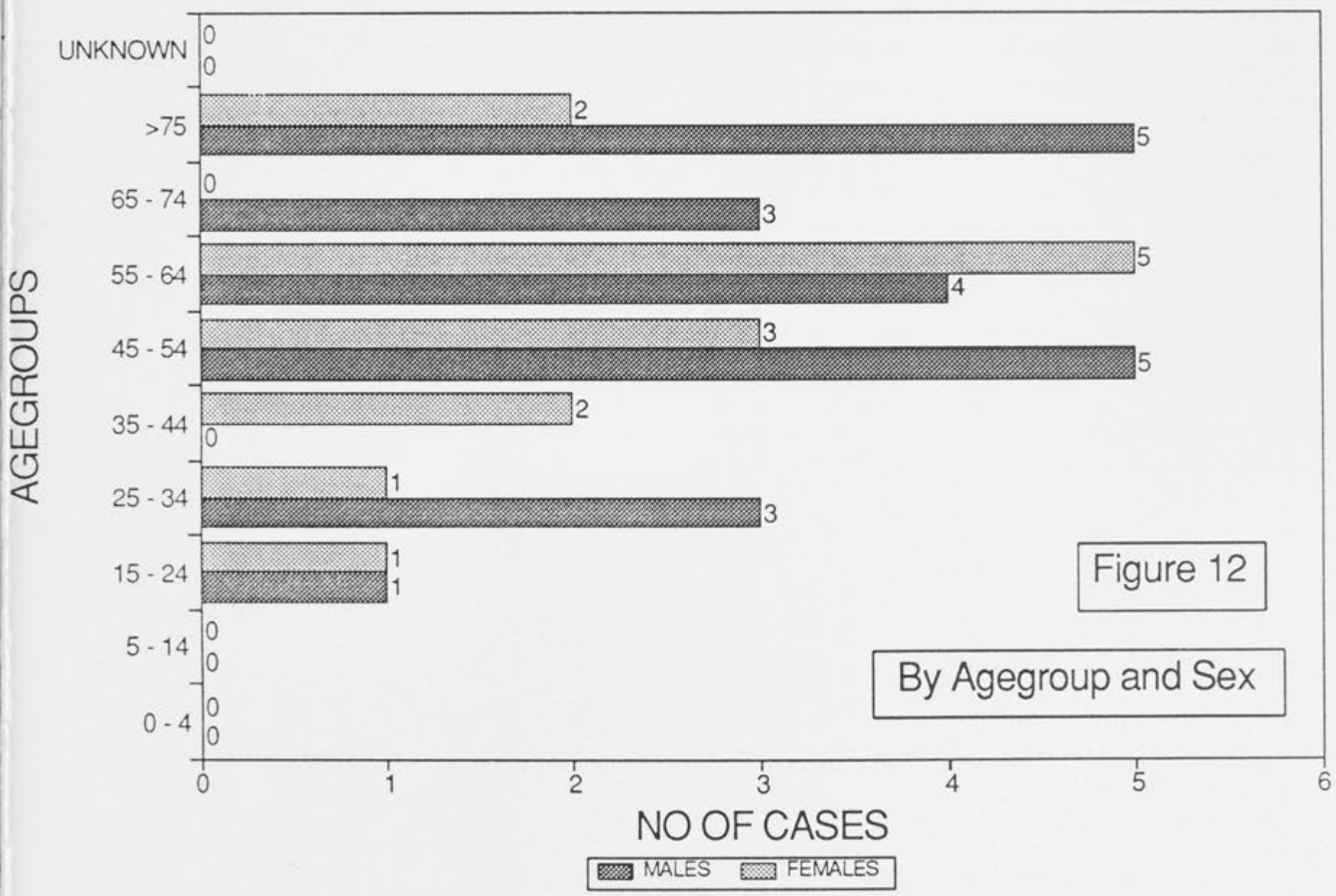


Figure 12

By Agegroup and Sex

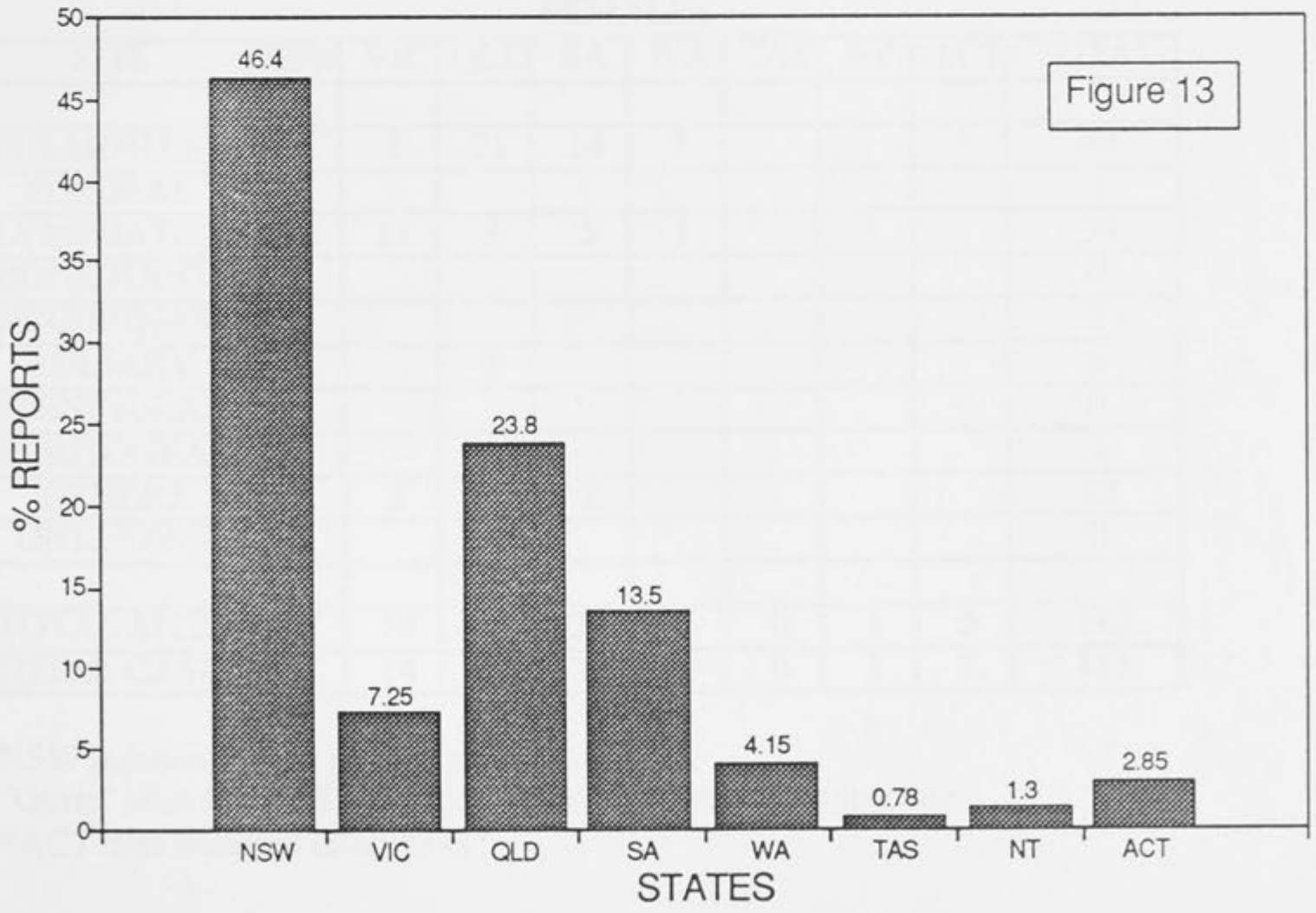
NOTIFICATION OF ATYPICAL DISEASE

TUBERCULOSIS IN AUSTRALIA 1990
TABLE 13 - ATYPICAL MYCOBACTERIUM NOTIFICATIONS
BY ISOLATES

ISOLATES	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	TOTAL
MAIS(General)	151	25	46	26	15	1	3	5	272
M Kansasii			4		1				5
M Scrofulaceum	1		1	2			1		5
M Marinum			4	1					5
M Ulcerans		3							3
M Chel/Fort.	3		28	5			1	5	42
M Gordonae	2		1					1	4
M Nonchrom.									0
M Terrae	4								4
Others	5		4						9
No bacteriology	13								13
Unknown			4	18		2			24
									0
TOTAL	179	28	92	52	16	3	5	11	386
% TOTAL	46.4	7.25	23.8	13.5	4.15	0.78	1.3	2.85	100

*ACT data include relapses (1)

TUBERCULOSIS IN AUSTRALIA 1990
ATYPICAL DISEASE (% REPORTED)



TUBERCULOSIS IN AUSTRALIA 1990
TABLE 14 - ATYPICAL MYCOBACTERIUM NOTIFICATIONS
LOCATION OF DISEASE AND SEX

MALES

SITE	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	TOTAL
PULMONARY	43	1	20	16	5		4	5	94
PLEURAL									0
LYMPHATICS	5	10	3	1		2		1	22
BONE/JOINTS			1		1				2
GEN/URINARY									0
MILIARY			10						10
MENINGEAL									0
PERITONEAL									0
OTHERS	83	3	14	13	1				114
UNKNOWN						1			1
TOTAL SITES	131	14	48	30	7	3	4	6	243
TOTAL CASES	131	14	48	30	7	3	4	6	243

FEMALES

SITE	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	TOTAL
PULMONARY	31	1	21	14	8			5	80
PLEURAL				1					1
LYMPHATICS	14	11	2	5	1		1		34
BONE/JOINTS									0
GEN/URINARY	3								3
MILIARY			2						2
MENINGEAL									0
PERITONEAL			1						1
OTHERS		2	18	2					22
UNKNOWN									0
TOTAL SITES	48	14	44	22	9	0	1	5	143
TOTAL CASES	48	14	44	22	9	0	1	5	143

*NSW pulmonary site include pleura
*"Other" sites from NSW include blood, stool and bone marrow
**ACT data includes relapses (1)

TUBERCULOSIS IN AUSTRALIA 1990
ATYPICAL MYCOBACTERIUM NOTIFICATIONS

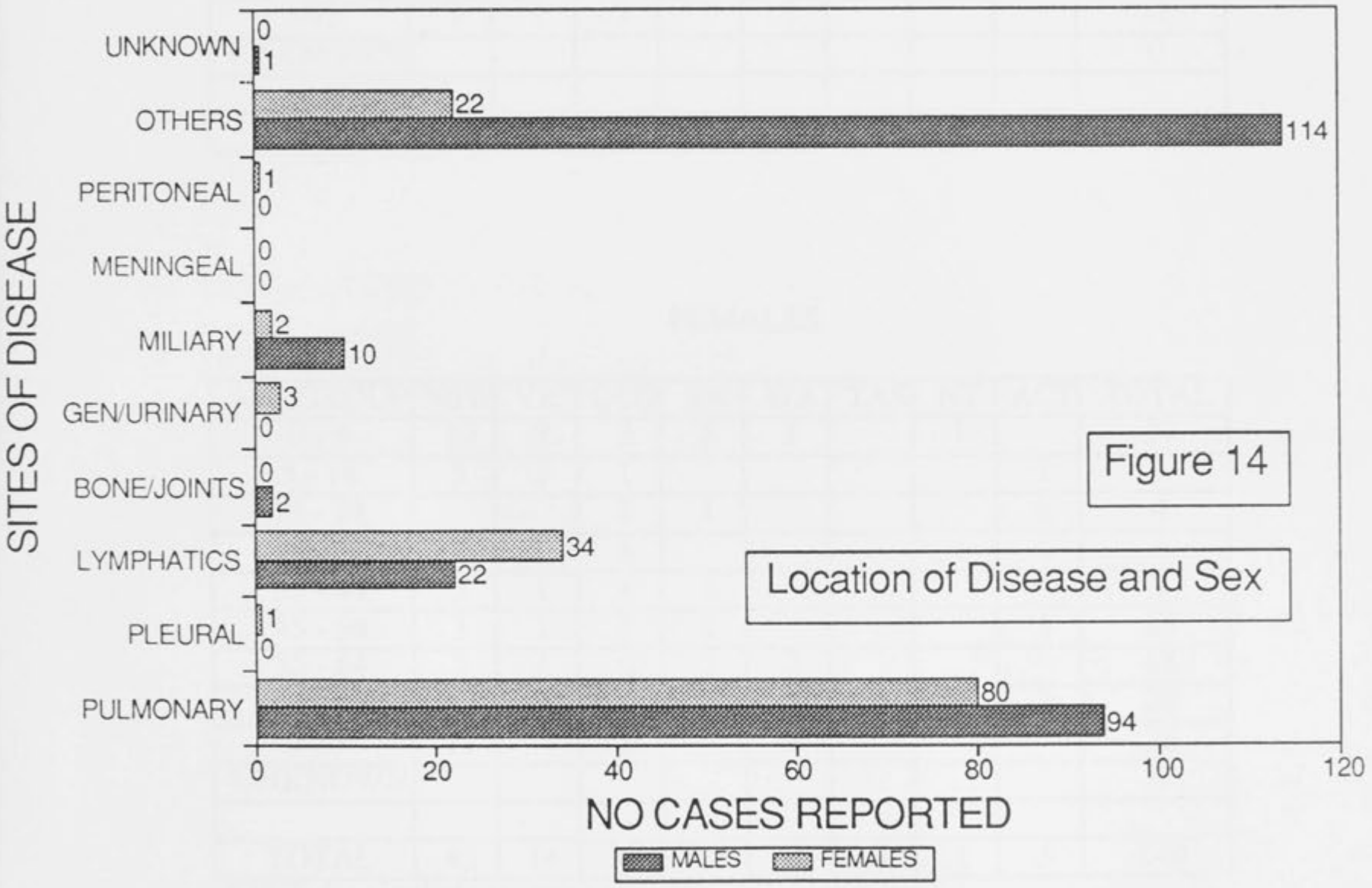


Figure 14

TUBERCULOSIS IN AUSTRALIA 1990
TABLE 15 (A) - ATYPICAL MYCOBACTERIUM NOTIFICATIONS BY AGEGROUP AND SEX

MALES

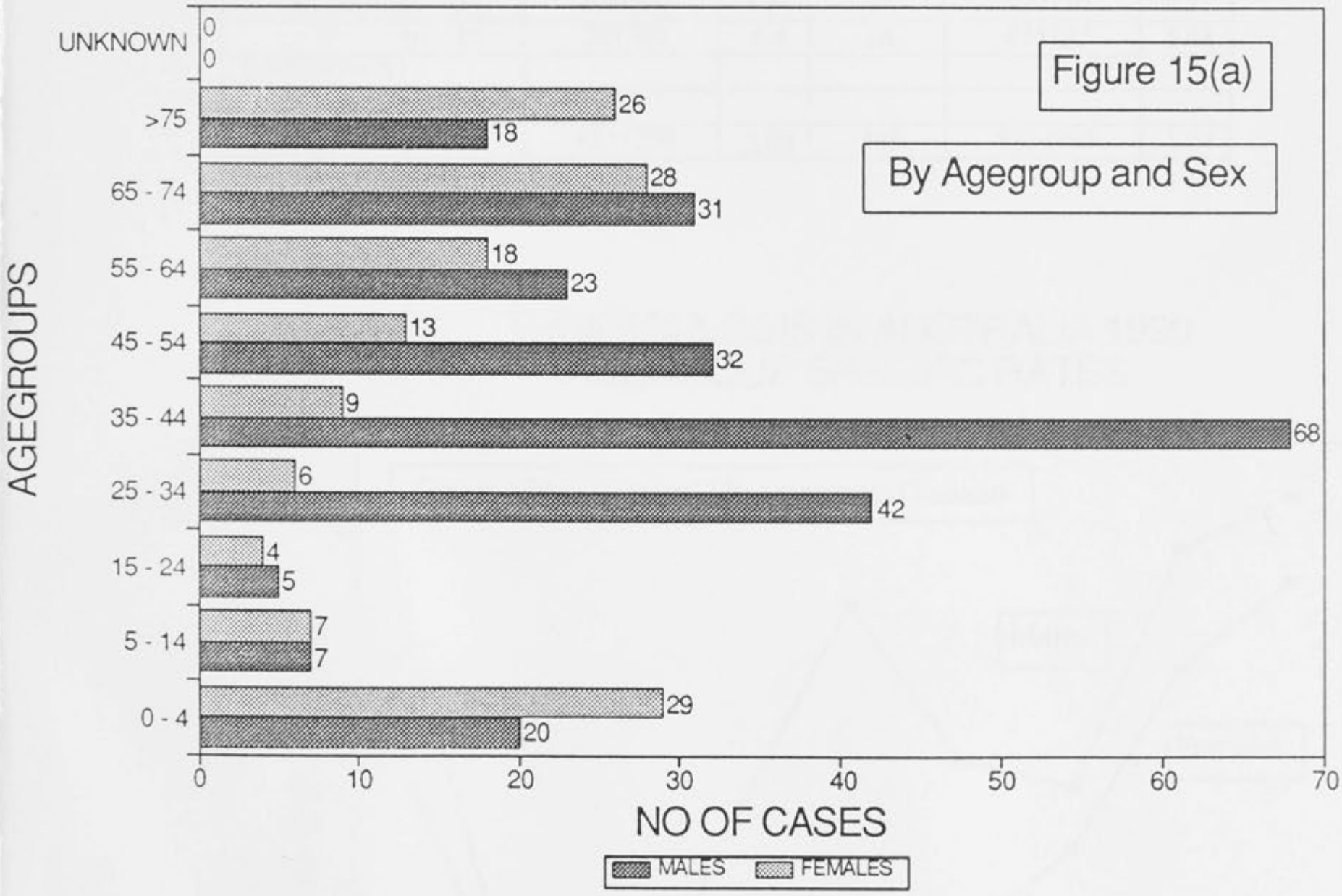
AGEGROUP	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	TOTAL
0 - 4	5	10	1	1		2		1	20
5 - 14	1	2	3	1					7
15 - 24	3		2						5
25 - 34	30		5	5				2	42
35 - 44	52		7	6	1	1	1		68
45 - 54	18		5	5	1		3		32
55 - 64	8		12	2	1				23
65 - 74	10	1	6	9	2			3	31
>75	7	1	7	1	2				18
UNKNOWN									0
TOTAL	134	14	48	30	7	3	4	6	246

FEMALES

AGEGROUP	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	TOTAL
0 - 4	10	9	3	5	1		1		29
5 - 14	3	2	1					1	7
15 - 24			2	1				1	4
25 - 34	1		5						6
35 - 44	2	1	4	1	1				9
45 - 54	3	1	7	1				1	13
55 - 64	5	1	6	3	3				18
65 - 74	10		8	7	1			2	28
>75	11		8	4	3				26
UNKNOWN									0
TOTAL	45	14	44	22	9	0	1	5	140

*ACT data include relapses (1)

TUBERCULOSIS IN AUSTRALIA 1990
ATYPICAL MYCOBACTERIUM NOTIFICATIONS



TUBERCULOSIS IN AUSTRALIA 1990
TABLE 15 (B) - ATYPICAL MYCOBACTERIUM NOTIFICATIONS
AGEGROUP SPECIFIC RATES

AGEGROUP	MALES	POPULATION	RATE	FEMALE	POPULATION	RATE
0 - 4	20	641745	3.12	29	611190	4.74
5 - 14	7	1275775	0.55	7	1212989	0.58
15 - 24	5	1413684	0.35	4	1353628	0.3
25 - 34	42	1423947	2.95	6	1396319	0.43
35 - 44	68	1304337	5.21	9	1279282	0.7
45 - 54	32	927338	3.45	13	880861	1.48
55 - 64	23	732290	3.14	18	725232	2.48
65 - 74	31	530698	5.84	28	620756	4.51
>75	18	281389	6.4	26	474737	5.48
UNKNOWN						
TOTAL	246	8531203	2.88	140	8554994	1.64

*Rate per 100,000
*ACT data include relapses (1)

TUBERCULOSIS IN AUSTRALIA 1990
AGEGROUP SPECIFIC RATES